1960

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PREMARITAL PREGNANCY IN THE UNITED STATES
Thomas P. Monahan

BIOLOGIC CONCEPTS OF SEX AND REPRODUCTION
Sheldon J. Segal

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The morning sessions will be devoted to the presentation of papers by the principal speakers.

The afternoon sessions will be devoted to group discussions of these papers, with about 15 symposium members in each group. Each group will have discussion leaders with special interest in the topics under discussion.

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A quarterly bulletin will be published and distributed among all interested groups.

The Organizing Committee would appreciate suggestions as well as names and addresses of individuals, Journals or Societies interested in receiving the Bulletin.

The abstracts of the papers to be read at the Conference will be published in advance by the Excerpta Medica Foundation (Amsterdam and New York) in a special issue priced at $5.00.

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a) Molecular Genetics, b) Cytogenetics, c) Genetics of Physiology and Auxology, d) Genetics of Morphological Traits, e) Anthropology and Race Genetics, f) Genetics of Immunohematology, g) Population Genetics.

II. Medical Genetics

a) Genetics of Infectious Diseases, b) Genetics of Metabolic Disorders, c) Genetics of Endocrinological Disorders, d) Genetics of Malformations, e) Genetics of Cardiovascular Diseases, f) Genetics of Blood Diseases, g) Genetics of Ear and Eye Diseases, h) Genetics of Dermatologic and Allergic Diseases, i) Genetics of Surgical Diseases (including Tissue Transplants).

III. Eugenics

IV. Genetic and Statistical Analysis

In addition to the above sections, three Symposia are foreseen, as well as a Joint Session with the 7th International Congress of Neurology:

1. Symposium: Cancer, Leukemia and Ionizing Radiations;

2. Symposium: DNA and Chromosomal Genetics: a revision of Mendel's Law?

3. Symposium: Dermatoglyphics.

Joint Session with the 7th International Congress of Neurology, on: Neurology, Psychiatry, Psychology and Genetics.

EXHIBITS

On the occasion of the Conference an Exhibition of Human Genetics is being planned, for which the widest possible participation and cooperation is invited, even possibly from those who may be unable to attend the Conference in person.

While a major exhibit will be prepared by the Secretariate using whatever information and material may be available, individual exhibits by various institutions and countries will be given special attention. The Exhibition Committee will provide proper forms for those who plan to prepare their own exhibits. The Committee wishes to point out that, while the exhibits should naturally be primarily planned so as to provide other researchers with the necessary scientific information and data, they should also possibly be understandable by less specialized observers. The Scientific Exhibition, in fact, ought to attract the general public, illustrating the history, scope, aims, achievements and problems of Human Genetics as a whole and in each of its branches. In order to attain this, the Committee will attempt to weave individual exhibits into an organic whole.

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Vol. 7, No. 3, September, 1960 *Eugenics Quarterly*

PREMARITAL PREGNANCY IN THE UNITED STATES
A Critical Review and Some New Findings[1]

THOMAS P. MONAHAN
The Municipal Court of Philadelphia

THERE HAS BEEN GREAT RETICENCE AMONG most authors of textbooks on marriage and the family about developing the subject of premarital coitus and pregnancy as one of the underlying circumstances of marriage for a large proportion of Americans (44; 45). The historian Charles F. Adams, in an essay on fornication, illegitimacy, and premarital pregnancy in early New England times, pointedly remarked upon the "almost systematic suppression of evidence" by writers in his day (1, p. 480; 2, pp. 159-60; 29, p. 600; 30, vol. 2, pp. 185-98; 7, Vol. 1, pp. 132-33, 154, 204, Vol. 2, pp. 43-44, 204, Vol. 3, p. 222). Recently, the investigations of Kinsey and his associates have done much to dispel the cloak of silence surrounding sexual behavior in general, but there is no doubt that present-day commentators and public figures tend to avoid the subject (32; 33; 27).

Even though sexual relations out of wedlock were severely frowned upon by early Colonial churchmen and leaders, according to the records of the time such a practice was quite common. The community was generally tolerant, provided marriage was forthcoming, especially if there were a child; and, one's spiritual salvation could be restored if a public confession were sincerely given. During a period marked by a "moral reawakening," one-third of the couples in one church who were admitted to communion made such a confession (1, p. 497; 7, Vol. 1, p. 133). As civil law gradually took precedence over church doctrine, we find that although fornication becomes punishable by statute, prosecution is often suspended by marriage before the birth of the child.

Premarital pregnancy is a rather common phenomenon in most societies. In Scandinavian countries and other parts of Europe, where the biological continuity of a family is a first consideration, premarital pregnancy is an accepted part of the marriage system, and we find that one-third and more of all first births occur within 7 calendar months of mar-

[1]This paper was delivered at the annual meeting of the American Sociological Association in Chicago on September 3, 1959. Some recent references have been added.

riage (8 to 20; 23, 24; 27; 56, pp. 40, 86, 600-01).

In Australia prior to the second World War over one-fourth of all first births occurred before the end of 7 months of marriage; recently, however, the proportion has been much smaller, being in 1955 some 18 per cent before the end of 7 months and 21 per cent before the end of 8 months of marriage (3; 4; 21, p. 40; 49, p. 173). Interestingly enough, premarital conceptions in England (among first births to women married once-only, roughly within 8½ months of marriage) came to about the same figure, or 20 per cent in 1955 (26, p. 90). In the United States, also, various estimates suggest that women who marry are pregnant at the time of marriage to about the same extent. The figures regarding premarital sexual intercourse for men and women, indubitably, are much higher.

REVIEW OF STUDIES

Because birth records in the United States do not contain information on the date of marriage, a determination of the extent and the characteristics of premarital pregnancy in this country as a whole cannot be made in a direct way.[2] Miscellaneous information does exist in the literature, much of it being an incidental by-product of special studies, such as those upon child marriages, elopements, widow-pensioners, desertions, divorces, marital adjustment subjects, birth control program participants, obstetrical and gynecological clinic cases, persons receiving psychiatric treatment, parents of juvenile delinquents, and so forth (27, p. 35—10 per cent; 5, p 64—white mountaineers, contraceptors, 25 per cent; 28, p. 100—parents of juvenile delinquents, 37 per cent, parents of non-delinquents, 28 per cent; and other references cited in this article). Unfortunately, many of these studies (besides being based upon rather selected population groups, with no common age or marital status refinement) do not specifically define what is meant by "premarital pregnancy."

In line with their interest in the success of "forced' or "shot-gun" marriages, social workers made premarital pregnancy a part of their inquiries into domestic discord. As early as 1915 the Philadelphia Municipal Court separated out this factor in its tabulations of social data on domestic relations cases (43: 1915, pp. 169, 180, 1916, p. 203, 1917, pp. 32-33, 81-82, 1918, pp. 39-40, 85; 39, p. 303). Premarital pregnancies, determined by comparing the date of marriage with the date of birth of the first child, among widows receiving support in one state were several per cent higher than the 1915 Philadelphia findings. In interpreting the discovery that 19 per cent of the widows were premaritally pregnant, Colcord pointed out that these families of widows "were by no means an unstable segment of the population," and offered the suggestion that many such marriages were not really *forced*, and would have been contracted anyway (22, p. 93). Raymond Pearl in the late 1930s similarly classified a large sample of hospital maternity records, widely gathered, but the proportion of births which he

[2]In Australia the day, month and year of birth and marriage are used in the determination; in Great Britain, the month (but not the day) of marriage is on the birth record. Birth records in the United States do not ask for date of marriage. The dates of marriage and births of family members have not been obtained in U. S. Census counts, either, and because of this the recently derived figures on births by duration of marriage and child spacing are only approximate, being especially inaccurate for the first year of duration of marriage. It is noteworthy that some published studies on child spacing ignore the element of premarital pregnancy. The 1960 U. S. Census does ask for month and year of birth and month and year of marriage in the sample enumeration.

termed prenuptial was much smaller: 7 per cent for white mothers and 22 per cent for nonwhite mothers (40). Unfortunately, the time interval allowed before counting a child as premaritally conceived was not given in these studies. Among a group of native white, Protestant, non-contraceptors in their primary (first) marriage, the findings of the Indianapolis fertility study, conducted at about the same time, indicate that premarital conception may have been as high as 16 per cent (34, pp. 68-69).

The derivation of this kind of information by a system of record linkage is an old one (references on request). As part of an inquiry to determine the completeness of birth registration, Stouffer in 1934 traced a large group of urban marriages, predominantly white, which took place in Wisconsin in 1930, making special use of city directories and the postal system. From these data he developed certain aspects of the premarital pregnancy pattern, considering children born "within 7 months" (not otherwise defined) after marriage as premaritally conceived, which amounted to 17 per cent of the whole (48, pp. 143-46; 49, pp. 154, 172-76).

At about the same time Christensen sought to discover by record linkage the interval from marriages of couples within a county in Utah to the birth of their first child, if any, in the next four years (8; 9; 10). And, resuming and extending his careful line of inquiry on child spacing some 10 years later, Christensen traced for a five-year-span marriages to birth records for couples within an Indiana county (11 to 15). He has become the chief American investigator in the field of premarital pregnancy and its outcome, and a modern proponent of the record-linkage method of study (16; 17).

MEASUREMENT

The matter of honesty in reporting dates of marriage and dates of birth of children where there is a premarital pregnancy is an unknown quantity, and on this point we may only hope that falsification does not vary much from group to group within a universe of data. Aside from the question of accuracy of reporting, the method of measurement of premarital pregnancy—whether lunar months or calendar months are used, and whether 7, 8, or 9 months is taken as the dividing point—clearly affects the magnitude of the percentage found. If all marriages are included, since some of them are childless, a marriage-based figure will be smaller than one derived from birth records; and refinement of measurement according to first-births and first-marriages also has relevance. In comparing different sets of figures, the exact point of reference or definition of premarital pregnancy should be kept in mind. A retrospective study will also be somewhat more adequate than one which traces marriages forward on a state or local level, particularly because recently married couples are mobile and the premaritally pregnant are known to move away (even if temporarily) to avoid attention within their county or community of residence. The results for specially chosen groups might also be expected to vary, depending upon the age-level or the marital type, the class or the subculture in question. Each set of data, therefore, requires careful appraisal.

However, regarding *special* population groups, provided they are not too selective or unique, it is reasonable to propose that *internal* subclassifications of the data with reference to such characteristics as age at marriage, race-or-color, religion, occupation, and the like,

will reflect the underlying *relationship* in the population as a whole. For, if the pattern of premarital pregnancy as between parts within a subgroup were not generally representative of the prevailing situation in the population from which they derive, then we would have to assume that premarital pregnancy was somehow sifting out more of the premaritally pregnant in one part of the subgroup than in another part. Furthermore, we would have to assume that different classifications of the data had similar distortions within each or all of their elements. When one appreciates the degree of interrelatedness of the various social characteristics, such completely chaotic biases—to invalidate *all* of the contrasts found in the different subclasses studied—cannot be expected. One finds much more reason to accept the proposition of "suggestive representativeness of *differences within* special groups" than the opposite. [Christensen's presentation of cross-cultural "regularities" in premarital pregnancy is in accord with this thesis (20)].

The likely representativeness of *internal contrasts within* specially chosen groups of data is additionally confirmed when (1) There is a reasonableness about the differences discovered in the data which argues for their tentative acceptance; and (2) Diversely phrased special studies all strongly point to the same broad relationships regarding age at marriage, occupation, religion, race-or-color, or migration. If such is the case, then, we have good reason to believe that there is a basic underlying trend in the data common to all, and that the findings, therefore, *roughly* represent the relative condition in the population as a whole.

However, the results from special kinds of populations, even those which have a broad origin, should not be used as a good demonstration of the magnitude of differences between groups or classes. The only satisfactory answer to the question of magnitude or complete representativeness would come from a general census or survey of the population, or record linkage, which is costly and has not been done for any sizeable group in the United States.

Family Problem Cases in Philadelphia

The Municipal Court of Philadelphia has been in operation for over 45 years and is well known in the community as an available socio-legal aid to families in difficulty. Although the principal legal issue of concern to the court in the domestic relations division is with the problem of non-support of wife or children (child dependency, delinquency, and illegitimacy being handled in other divisions of the court, while divorces are heard elsewhere), non-support is often not the exclusive or main issue in contention. All manner of family difficulties impel husbands and wives to seek out court assistance, ranging from family quarrels, or simple desertion by the spouse, to grievous cases of assault and battery (43, 1957). Basically, these cases are largely self-initiated and do not depend on social-worker referrals or relief-agency actions. A large proportion of the couples are living together, and their cases are settled often without a *court* hearing.

Statistical data presented in the Annual Reports of the court and elsewhere over the years show that while certain population classes appear more often than others with domestic problems, no segment of society is without some representation and the selectivity in these cases is a moderate one. The court is

available to all and is used by all classes; it is not just a "poor man's court."

Premarital pregnancy, of course, does not inevitably lead to difficulty or preclude a lasting marriage. And, even in the more limited area of divorce where premarital pregnancy seems to increase the risk (14, 20), the great majority of divorce cases originate for distinctly different reasons (37, p. 24). Family problem cases of the kind to be analyzed here, it may be seen, draw upon an even larger part of the population. In the period 1950 to 1954, about 4,500 new families came to the domestic relations division each year for help, while Philadelphia marriages were averaging 15,000 a year, and divorces 3,200 a year.

Out of a total of 5,086 *new families* making application in the domestic relations division in 1954, 3,509 primary marriage families where the wife was a Philadelphia resident were separated for detailed analysis. Those couples who had children born before the expiration of 8 calendar months and 14 days were classed as premaritally pregnant, using the day-month-year of marriage and the day-month-year of birth of the children. (In addition, a smaller scale study of family cases in 1953 was made, counting children born in less than 8.0 calendar months as premaritally conceived.) Because various other facts were extracted from the records, it was possible to relate premarital pregnancy to other characteristics of the family. For the reasons given above, it is believed that this information will shed light on the probable *variation* regarding premarital pregnancy within the population as a whole. Of course, because the families are a special type, with "court" problems, these findings cannot be taken as an *accurate* gauge of the *magnitude* of premarital pregnancy in the total population of Philadelphia or any of its elements.

Trend. The proportion of premarital pregnancy manifested in different time periods is known to vary (3; 11, p. 57). In the Philadelphia court data for 1917 and 1918 (discarding the 1915 and 1916 results as somewhat dubious), the proportion of "forced" marriages (undefined) was about 14 per cent. Using the data for 1953, 471 primary white marriages in 630 families and 410 Negro primary marriages in 525 families, and weighting downward the Negro part of the total to compare with the population distribution in 1917-18, we find that 17 per cent of all couples had given birth to a child in less than 8.0 calendar months after marriage. A large part of the 3 per cent difference could be accounted for *if* a 7 month measure had been used at the earlier date. Nothing, therefore, can be said positively about any trend in premarital pregnancy among the families which came to court on the basis of these data.

Marital Type, Race or Color. *None of the studies made heretofore have refined their data for both race-or-color and marital type,* although such a distinction seems a fundamental one in marriage and family studies. It should be noted, however, that in most of the studies the populations were predominantly white. From the one major study which delineated the racial aspect, Pearl's study of maternity cases (40, pp. 181, 330; cf., 5, pp. 61-62), it might be expected that premarital pregnancy and illegitimacy would vary with race. In the United States, nationality or national origin data are becoming statistically indistinguishable because of intermarriage.

The 1917-18 court figures on race and *nationality* disclosed variations between the classes, although for some reason the

contrast between the whites and Negroes was small (Cf., 50, pp. 77, 135, 226; 51). If we compare the premarital pregnancy proportion in court families in 1953 (using 8.0 months or less as the measure) with the "forced" (undefined) marriage proportions in 1917-18, the figures for all classes of marriages of whites are 14 per cent in both periods; but, for the Negroes the proportions are 15 per cent in 1917-18 and 38 per cent in 1953. Whether this means that Philadelphia Negroes (or even those who come to court) have relaxed their moral standards cannot be said with any assurance, however.

In the domestic relations cases for 1954, Negro *primary* marriages (a first marriage for both parties) revealed a considerably higher proportion of children born in less than 8 calendar months and 14 days following marriage, in comparison to that shown by previously divorced or widowed couples, or 46 versus 22 per cent. White *primary* marriages registered only a slightly higher proportion than the remarried, or 20 versus 18 per cent. Court families of the remarried type quite often do not have children of the present marriage, reducing their premarital potentiality, and information on children in such families is somewhat unclear, on the whole. These are strong technical reasons for refinement of the data for first marriages only.

In line with the foregoing, the 1954 family cases were tabulated and analyzed in terms of primary marriages subclassified for whites and Negroes.

In some of the cases no children had been born. If the wives in the primary marriage groups who had no children ever-born are excluded from the 1954 figures, the proportions of those who had children of this marriage born within 8 months and 14 days after marriage increase from 20 per cent on a family basis to 22 per cent on an offspring basis for the whites, and from 46 to 51 per cent for the Negroes (Cf. 11, p. 57). As can be seen from Table 1, in a certain proportion of the families children were actually being born before the marriage

TABLE 1

PREMARITAL PREGNANCY
Primary Marriages of Domestic Relations Cases* Philadelphia, 1954

	Whites	*Negroes*
Number of cases	1,765	1,744
	Per Cent of Cases with Pramarital Pregnancy	
Total	20.1	45.6
Child not yet born	.9	.7
Child born:		
After marriage	17.6	30.3
Before marriage only	1.0	9.8
Before marriage and another pregnancy	.6	4.8

*Primary marriages are those in which both parties are married for the first time. Using the day-month-year of marriage and the day-month-year of birth of the first child to each married couple, all those having children before the end of 8 months and 14 days after marriage were considered as premaritally pregnant. A smaller study of cases in 1953, using 8.0 months as the point of measurement (471 white and 410 Negro first-marriages) disclosed premarital pregnancy percentages of 14.6 and 44.0, respectively. Excluded from the above calculation were 8 white and 13 Negro couples for whom premarital pregnancy could not be determined.

took place: 1.6 per cent for the whites and 14.6 per cent for the Negroes. Since marriage in these cases comes after children are born, it might be supposed that free hospitalization and relief policies (Aid to Dependent Children under the Social Security Act) regarding "illegitimate" children might be a contributory factor in this result (41; 42).

Type of Case. The classification of families in terms of the type of case they represent is somewhat of a judgmental matter, even as regards the charge of non-support. However, as between whites and Negroes, the degree of premarital

pregnancy is more than twice as high for Negroes in nearly every category. The type of family problem alters but does not change the strong contrast in the percentages as between whites and Negroes.*

Type of Ceremony. All family cases in 1915 and 1916 (not refined for marital status), in spite of their overall ambiguity, showed civil ceremony marriages to be twice as often "forced" as were marriages initiated under religious auspices —for both whites and Negroes. Christensen's population studies confirm this relationship (11; 19; 20).

Oddly enough, the Negro group of *primary* marriages in the 1954 court cases shows no pronounced variation according to type of ceremony. This might mean that for Negroes religious and civil marriages do not represent distinct categories.

However, in the white group of first-marriage families, not only do the religiously officiated marriages show about half the proportion of premarital pregnancy which appears in the civil-ceremony-only group, but also, rather significantly, those white first-marriages which were followed by a second ceremony (usually a church marriage following the civil marriage) register a percentage with premarital pregnancy falling midway between the religious-only and civil-only types of marriage ceremony. These double ceremony marriages may have a certain precipitousness about them, not necessarily due to pregnancy. (See Table 2.)

Religious Belief. Stouffer's urban data for Wisconsin showed no overall difference in the degree of forced marriage as between those performed by a Catholic or a non-Catholic officiant; nor did Pearl's maternity cases show any difference between white Catholics and white Protestants (49, p. 175; 40, p. 181). Catholic "divorces" studied by Thomas, however, indicated that the mixed-Catholic group had a somewhat higher degree of premarital pregnancy (undefined) than the rest (50, pp. 82, 150; 51, p. 106).

Comparing Protestants with Catholics in the 1954 domestic relations cases, no noteworthy difference appears in the primary marriages of the whites as to premarital pregnancy. Only the Jewish group, as was true in Pearl's study, shows a lower registration in this regard. The higher socio-economic position of the Jewish group, and all that this connotes, would tend to account for their lower rate. The mixed-Catholic groups and the mixed-Protestant denominations, according to these figures, have higher proportions of premarital pregnancy than others in their respective classes (both Catholic, both of the same Protestant denomination; see Table 3.)

Among the Negroes, the variations between the religious groups are not at

*Table available on request.

TABLE 2

PREMARITAL PREGNANCY
by Type of Marriage Ceremony*
Philadelphia, 1954

Type of Ceremony†	WHITES		NEGROES	
	Number of Cases	*Per Cent Premaritally Pregnant*	*Number of Cases*	*Per Cent Premaritally Pregnant*
Total	1,765	20.1	1,744	45.6
Religious	1,319	17.0	1,406	46.4
Double	120	25.0	3	—
Civil	308	32.8	318	42.8
Not given	18	—	17	—

*Primary marriages. (See Table 1.)

†Religious includes a small number of joint civil-religious ceremonies, usually on the same day. Double ceremony marriages include second performances for the same marriage at different dates or places. Civil includes a few common law marriages. Not given includes ceremony or premarital pregnancy unknown.

TABLE 3

PREMARITAL PREGNANCY BY RELIGIOUS GROUPING*
PHILADELPHIA, 1954

Religious Grouping (Husband-Wife)	Whites		Negroes	
	Number of Cases	Per Cent Premaritally Pregnant	Number of Cases	Per Cent Premaritally Pregnant
Total	1,765	20.1	1,744	45.6
Both Catholic	923	20.0	47	(45.7)
Catholic-Protestant	176	19.5	92	(52.2)
Protestant-Catholic	222	25.2	100	58.2
Jewish Both, or One Protestant	120	10.1	†	†
Both Protestant	(324)	21.2	(1,505)	44.4
Same Denomination	186	17.3	221	44.7
Mixed Denomination	138	26.5	451	43.4
Both Baptist	†	†	833	44.9

*Primary marriages. (See Table 1.)
†Inapplicable or not separately tabulated.

all outstanding, but, once again, the percentages in all religious subdivisions are distinctly higher than among the whites. Only the mixed-Catholic Negroes resemble the white pattern of percentage increase in premarital pregnancy with mixture of religion.

Age at Marriage and Relative Age. A number of previous studies have shown that premarital pregnancy is highest at the younger ages and decreases with later age at marriage (11; 19; 20; 27; 46, p. 406; 50, pp. 150, 175, 182, 227; 51, p. 107). In the 1954 (and 1953) Philadelphia family cases we find the same situation with respect to the husband's and the wife's age at first marriage. (See Table 4.) No clear pattern of *births* before marriage, premaritally conceived, by age at marriage of the wife appears in the results, however.

Where the wife is older than the husband (whites and Negroes), or of the same age as the husband (whites), there seems to be a tendency for premarital pregnancies to be lower than the average. This is in accord with other findings, but the relative age relationship does not stand out as a predominant one in the scope of this study (50, pp. 89-91).

TABLE 4

PREMARITAL PREGNANCY
BY AGE AT MARRIAGE OF WIFE*
PHILADELPHIA, 1954

Age of Wife at Marriage	Per Cent Pregnant Before Marriage	
	Whites	Negroes
Total	20.1	45.6
Under 16	(29.5)	58.4
16	26.1	59.0
17	28.1	52.2
18	23.3	56.8
19	22.4	44.0
20	17.0	40.9
21	18.2	39.4
22	16.2	39.4
23	(14.4)	(25.0)
24	(15.6)	(26.5)
25-29	12.4	31.9
30 & over	(16.7)	(23.4)

*Primary marriages. (See Table 1.) Age not stated for 6 white and 16 Negro wives. Percentages based on less than 100 cases are shown in parentheses.

Migration Type. In the white group, where both parties were born elsewhere or only one was born in Philadelphia, the proportions with premarital pregnancy tended to be lower than for couples who were both born in Philadelphia. However, native-born Philadelphia couples who were married elsewhere showed a much higher percentage with premarital pregnancy than those who were married in Philadelphia. [See

TABLE 5

PREMARITAL PREGNANCY BY MIGRATION STATUS*
PHILADELPHIA, 1954

Place of Birth — Place of Marriage	*Number of Cases*	*Per Cent with Premarital Pregnancy*
	Whites	
Total	1,765	20.1
Both Parties Born in Philadelphia		
Married in Philadelphia	567	19.5
Married Elsewhere	370	26.6
One Party Born in Philadelphia	530	17.6
Both Born Elsewhere and Remainder	298	17.9
	Negroes	
Total	1,744	45.6
Both Parties Born in Philadelphia	315	61.0
One Party Born in Philadelphia, Spouse Not Born in South	124	47.2
One Party Born in South, Spouse Born Elsewhere (not South)	535	49.0
Both Parties Born in The South		
Married in the South	553	33.6
Married Elsewhere	217	44.9

*Primary marriages. (See Table 1.) Categories are mutually exclusive in descending order

Table 5, (53, 1957, p. 224).] Surprisingly enough, for whites and Negroes, in both 1953 and 1954, first marriages which took place in Elkton, Maryland, which was a Gretna Green in former times, showed only a slightly higher percentage of premarital pregnancy than the overall average.

In the Negro group the results were quite remarkable and contrary to expectations. Only a small proportion of the first-marriage couples (18 per cent) were both born in Philadelphia, but in this group was found the highest percentage of premarital pregnancy: 61 per cent. Where only one party was born in Philadelphia, or one party was born in the South, the percentages drop to 47 and 49 per cent, respectively. But the lowest figures of all were for couples *both of whom* were born in the South and married there, 34 per cent; while those couples who were both born in the South but married elsewhere showed an intermediate figure of 45 per cent. Indeed, since at least one spouse was born in the South in three-fourths of the cases, the overall proportion of premarital pregnancy for the Negroes would have been much higher if they had followed the style of the native-Philadelphia Negro couples coming to court.

One interpretation of the 34 versus 61 per cent contrast in the Negro data might be that native Philadelphia Negro brides who are pregnant at the time of marriage have a greater likelihood of appearing in court than do those native Philadelphia Negro brides who are not premaritally pregnant; and that this same tendency does not apply to the Southern-based Negroes. There is not much reason to expect such an unequal parceling out with respect to premarital pregnancy as between Negroes of different mobility statuses. On the other hand, if the results are taken tentatively as an indication of the conditions that might actually prevail in the Negro population, then it might be supposed that Southern Negroes do not wait until the circumstances of pregnancy precipitate a marriage, but rather they move directly into marriage at an early age; while

the more mobile Southern Negroes, and Northern Negroes who become family court cases show a greater and greater tardiness in formalizing their marriages. Even illegitimacy in these court cases among Southern-based Negroes is slightly below the average. It is worth noting, also, that delinquency among children of Negro migrants into Philadelphia is lower than for native Philadelphia Negro children (47).

Duration of Marriage. Among both the whites and the Negroes, again with the Negroes showing much higher percentages in every subdivision, the proportion of marriages with premarital pregnancy declines with increasing length of time the couples had been married prior to separation, or—if still living together—prior to the time of application to the court. This is in agreement with Thomas's findings for Catholic divorces (50, pp. 99, 212, 228; 51, p. 105; cf., 31, p. 48). (See Table 6.)

A rather unique and outstanding relationship is evidenced by the figures on median duration of marriage for these families in trouble. For white couples in their first marriage, the median duration for those who were *not prematurally* pregnant and still *living together* was 9.2 years; for those already separated it was 5.5 years; premarital pregnancy without illegitimacy, and then premarital pregnancy with illegitimacy cause additional declines in the median duration. The Negro figures start out at 7.8 median years of duration for those not prematurally pregnant and still living together, and 5.1 years for those not prematurally pregnant but separated; and then the total figures drop in a similar manner to 3.6 years with premarital pregnancy alone, and to 2.7 years with illegitimacy added to the picture.

TABLE 6

PREMARITAL PREGNANCY* BY DURATION OF MARRIAGE PHILADELPHIA, 1954

Duration of Marriage in Years	*Per Cent of Cases with Premarital Pregnancy*	
	Whites	*Negroes*
Total	20.1	45.6
0	31.1	56.5
1	31.1	57.9
2	24.8	58.5
3	25.0	49.4
4	19.0	51.1
5	21.4	44.3
6	14.9	43.7
7	12.4	(31.2)
8-9	12.0	28.8
10-11	(13.1)	26.7
12-14	20.9	30.6
15 & Over	14.2	37.2

*Primary marriages. (See Table 1.) Figures in parentheses are based on less than 100 cases. Duration was not given for 38 white and 44 Negro families.

Here we see for couples living together, and for couples living apart, how they separate or come to court sooner if they have conceived children before marriage. The quickening of family crisis and separation is considerable. Persons who enter marriage under such circumstances, it seems, have special liabilities and difficulties facing them. Undoubtedly, this is to some extent also a result of couples being forced into marriage to protect the mother or to give the child a name, with youthfulness of the partners, and concomitant difficulties, adding further to the adjustment problems. Illegitimacy (children not of this union) in addition to premarital pregnancy before marriage shortens the marriage most of all. For Negro couples, especially, the total family problem is accentuated by the illegitimacy factor. (See Table 7.)

Occupational Level. Premarital pregnancy has been found to prevail to a greater degree in the lower occupational

TABLE 7

PREMARITAL PREGNANCY AND MEDIAN DURATION OF MARRIAGE
PHILADELPHIA, 1954

Premarital Pregnancy	*Median Duration of Marriage*					
	Total	*To Application*	*To Separation*	*Total*	*To Application*	*To Separation*
	Whites			*Negroes*		
Total	6.0	8.2	4.9	4.7	6.5	3.9
Not premaritally pregnant	6.5	9.2	5.5	6.0	7.8	5.1
Premaritally pregnant	3.9	5.4	3.3	3.6	4.9	2.9
(With illegitimacy)	—	—	—	2.7	(4.2)	(2.0)

— Signifies too few cases for determination. ( ) = less than 100 cases.

*See footnote to Table 1. Duration to application relates to cases where couples are still living together; duration to separation, for couples who have separated. The total is a composite of the durations to application and to separation. Illegitimacy in these first-marriage cases refers to children not born to this couple. The figures are a minimum because some may not be reported, especially the husband's illegitimate offspring. In addition to premarital pregnancy (this marriage), 3 per cent of all white first-marriages showed additional children born out of wedlock to husband or wife, and 12 per cent for Negro families.

levels (11; 12; 19; 20; 31, p. 38; 40, p. 330; 49, p. 175; 50, pp. 95, 197, 227; 51, p. 104). Some persons argue, therefore, that the much higher Negro rate is merely a reflection of their occupational position. In the 1954 Philadelphia court cases there appears to be a rather definite inverse relationship between premarital pregnancy and occupational level among the white couples but only the suggestion of such a relationship for the professional and managerial class of Negro couples. (See Table 8.) This is in agreement with the only other study reporting on this racial variation (Pearl).

In all of the occupational levels the Negro percentages far exceed the percentages for the whites with premarital pregnancy. Even within the laboring group the premarital pregnancy figure for Negroes is much higher than for whites. The professional and managerial group of Negroes (but not the clerical group) tend to show a diminution in the prevalence of premarital pregnancy, but they still show as a group relatively twice the proportion registered by the professional and managerial group of

TABLE 8

PREMARITAL PREGNANCY
BY OCCUPATIONAL LEVEL*
PHILADELPHIA, 1954

Socio-economic Group of Husbands	*Per Cent of Cases With Premarital Pregnancy*	
	Whites	*Negroes*
Total	20.1	45.6
Professional and semi-professional	(15.7)	(34.2)
Managers, owners, and officials	14.2	(31.6)
Clerical and sales	13.1	50.0
Craftsmen and foremen	19.2	43.3
Semi-skilled workers	21.1	44.3
Service workers**	(21.7)	(43.9)
Laborers and menials	27.5	45.5
Retired, military, and not stated***	32.7	57.0

*Primary marriages. (See Table 1.)

†Grouped according to the occupational classification of the United States Bureau of the Census, *Alphabetical Index of Occupations and Industries, Revised Edition, 1950*, Washington, D. C.: Bureau of the Census, 1950.

**This includes policemen, firemen, barbers, waiters, chefs, bartenders, and the like. Janitors, attendants, elevator operators, and the like were placed with laborers and menials.

***The number of cases in this group amounted to 105 for the whites in the total of 1,765, and 129 for the Negroes in a total of 1,744.

Figures in parentheses are based on less than 100 cases.

The white-collar groups, the first three, combined show a figure of 14.0 per cent for the white families, and 44.7 per cent for the Negro families.

whites. The lack of contraceptive knowledge can hardly be paramount in this upper class. The equivalence of occupational groups between whites and Negroes may be questioned, and it would be desirable to control the comparisons still further for education, income, occupational mobility (Cf. 36), and neighborhood. Undoubtedly segments of the Negro group accept and conform to the mores of the white majority. However, one interpretation of these data, taking into account some other evidence, is that there is a fairly common set of attitudes or sexual performance at all levels within the Negro group, at least for the cases which appear in this study. [Illegitimacy, separately tabulated (unpublished) for these married couples, shows the same basic pattern as between whites and Negroes by occupational level.]

Undoubtedly there are several explanations for the differences within the white group. The upper occupational levels of whites may have a greater or more sophisticated knowledge of contraception, as well as different courtship patterns. There may be more self-discipline also in the higher occupational levels or other social outlets, in spite of their delayed age at marriage. In the lower occupational levels where future social and economic expectations may be low, and where any delay between the time of biological maturity and the time for social maturity for marriage may be something of a barrier to be circumvented, fortuitous pregnancies could easily result. Whatever the explanation, the noticeable differences between occupational levels in the extent of premarital pregnancy for white couples is probably a general one in our society.

CONCLUSION

One anthropologist of eminence, George P. Murdock, speaking before the American Sociological Society in 1949, predicted the acceptance of premarital sex relations, as a form of trial marriage, in our society "within a very few generations," and personally approved of the expected change (38; 54; 55). Of course, great reliance was placed upon the use of contraceptives, so that the possibility of illegitimacy and premarital pregnancy were secondary issues. The problems surrounding illegitimacy and forced marriage (wherein couples have no original disposition to marry) cannot be lightly considered or ignored, however. At the same time it should be recognized that some premarital pregnancy in the United States may be merely a form of marriage precontract, or an anticipation of marriage, as it is in some other societies. If it were possible, the two kinds of circumstances should be separately investigated.

In a general way pregnancy before marriage may be considered to be one of a cluster of factors which characterize some families as being different from the rest. While there is some evidence to indicate that premaritally pregnant couples may be more disposed than the average to divorce (and perhaps desertion, non-support, and other unfavorable outcomes), at the same time it is well to remember that the great majority of white families which are separated, divorced, or in domestic discord are not in the premaritally pregnant class.

The premaritally pregnant figure of 20 per cent found for the first-marriage, Philadelphia white couples in domestic difficulty in 1954, therefore, might be taken as probably not much higher than the prevailing extent of conception before marriage among all Philadelphia white families (using 8 calendar months and 14 days as the measure). Christen-

sen obtained a roughly similar figure of 21 per cent for the general population of Tippecanoe County (Lafayette), Indiana, and a slightly lower rate for Utah County (Provo), Utah (11; 20, p. 33). Taken along with other studies, it could very well be that if all the facts were known *conception* takes place before marriage in about one out of five cases in the United States, recognizing however that many such marriages are by no means "forced."

The main outlines of the phenomenon of premarital pregnancy may be given tentatively as follows: (1) It is more typical of Negroes than of whites, and may also vary with ethnic or national-cultural origin; (2) The lower occupational levels of whites (not as clearly or certainly for Negroes) show a greater proportion of this kind of behavior than the white-collar and professional classes; (3) There is also some evidence which suggests that premarital pregnancy may decline with higher educational achievement (40, p. 182; 27, p. 45); (4) Metropolitan cities may evidence more of this behavior than smaller urban communities, although the rural-urban contrast has not been well demonstrated (49, p. 175; 11; 12); (5) Catholics and Protestants have shown no difference in this regard, although mixed-Catholic marriages tend to register more premarital pregnancy than homogamous religious marriages. Jewish couples, probably due in part to their favorable occupational position, are less often premaritally pregnant; (6) The younger the age at marriage the greater is the degree of premarital involvement; (7) Civil ceremony marriages show considerably more conceptions occurring before marriage takes place (for the whites); (8) Mobility, as evidenced by place of birth and place of marriage among Philadelphia court families, shows somewhat of a contrary relationship to the expected one: the Philadelphia-based Negroes, in particular, and not the migrants having the highest proportion with pregnancy before marriage; and (8) Finally, the length of acquaintanceship in general is shorter and the length of engagement is often little or none in premarital pregnancy cases (50, p. 158-59, 167, 227; 51, p. 106).

The rate of illegitimacy for the Negro group is higher than for the whites, and the rate is growing. As these Philadelphia data and Pearl's study show, Negroes have a much higher rate of premarital pregnancy than the whites, also (40, pp. 181, 330). The higher rate is hardly to be attributed to social and economic status, because premarital pregnancy is quite considerable in the upper as well as in the lower occupational groups of Negroes, and the ratio of the proportions in the occupational scale is about the same as between whites and Negroes. Migration does not explain the result either, since in the domestic discord cases studied the Northern-based Negroes far exceeded the Southern-based Negroes in the custom or practice. Because of the finding regarding migration status, the theory that somehow the "slave culture mores" imposed upon the Negro are responsible for the results is rendered doubtful in the present-day context. One interpretation, recalling the extent of the behavior in Puritan New England and colonial times, is that Negroes may be following a custom of marriage precontract and have not come to accept the prevailing formal norms of the community, and are thereby evidencing a form of cultural lag. There is a strong presumption, nevertheless, that the sex customs of the Negroes as a whole are part of an American subcul-

tural system (25, p. 11; 35, pp. 267ff; 53, pp. 3-29).

Premarital pregnancy is certainly worthy of more painstaking research and discussion, in view of the extent of this kind of behavior and its consequences in family life.

REFERENCES

1. Adams, C. F. 1891. Some phases of sexual morality and church discipline in colonial New England. *Massachusetts Hist. Soc. Proc.*, series 2, **6**: 477-516.
2. Adams, J. T. 1927. *Provincial Society, 1690-1763*. New York: Macmillan Co.
3. Australia, Commonwealth Bureau of Census and Statistics. 1956. *Official Yearbook of the Commonwealth of Australia*. Canberra, Australia.
4. ————. 1957 and preceding. *Australian Demography*. Canberra, Australia.
5. Beebe, G. W. 1942. *Contraception and Fertility in the Southern Appalachians*. Baltimore: Williams & Wilkins Co.
6. Breidenbaugh, B. 1955. A study of factors in the success or failure of marriages involving premarital pregnancy. Unpublished M.A. thesis, Purdue University.
7. Calhoun, A. W. 1917. *A Social History of the American Family*. (3 vols.) Cleveland: Arthur H. Clark Co.
8. Christensen, H. T. 1937. A comparative study of the time-interval between the marriages of parents and the birth of their first child, based on 1,670 couples in Utah County, Utah, 1905 to 1935. Unpublished Ph.D. thesis, Brigham Young University.
9. ————. 1938. Rural-urban differences in the time-interval between the marriage of parents and the birth of their first child, Utah County, Utah. *Rur. Sociol.*, **3**: 172-176.
10. ————. 1939. The time-interval between marriage of parents and birth of their first child in Utah County, Utah. *Amer. J. Sociol.*, **44**: 518-525.
11. ————. 1953. Studies in child spacing, I—premarital pregnancy as measured by the spacing of first birth from marriage. *Amer Sociol. Rev.*, **18**: 53-59.
12. ————. 1953. Rural-urban differences in the spacing of first births from marriage: a repeat study. *Rur. Social.*, **18**: 60.
13. Christensen, H. T. and Bowden, O. P. 1953. Studies in child spacing, II—the time-interval between marriage of parents and birth of their first child, Tippecanoe County, Indiana. *Soc. Forces*, **31**: 346-351.
14. Christensen, H. T. and Meissner, H. H. 1953. Studies in child spacing, III—premarital pregnancy as a factor in divorce. *Amer. Sociol. Rev.*, **18**: 641-644.
15. Christensen, H. T., Leslie, G. R and Pearman, G. L. 1955. Studies in child spacing, IV—the time-interval separating all children in completed families of Purdue University graduates. *Soc. Forces*, **34**: 77-82.
16. Christensen, H. T. and Rubenstein, B. B. 1956. Premarital pregnancy and divorce: a follow-up study by the interview method. *Mar. and Fam. Liv.*, **18**: 114-123.
17. Christensen, H. T. 1958. The method of record linkage applied to family data. *Mar. and Fam. Liv.*, **20**: 38-43.
18. ————. 1958. Value variables in pregnancy timing. (Chapter in Nels Anderson, ed. *Studies of the Family*, Vol. 3. Gottingen, Germany: Vanderhoeck & Ruprecht, 1958, pp. 29-45).
19. ————. 1959. Selected aspects of child spacing in Denmark. *Acta Sociolgica*. **4**: 35-45.
20. ————. 1960. Cultural relativism and premarital sex norms. *Amer. Sociol. Rev.*, **25**: 31-39.
21. Coghlan, T. A. 1899. *Childbirth in New South Wales*. Sydney, Australia: W. A. Gullick, Govt. Printer.
22. Colcord, J. C. 1919. *Broken Homes*. New York: Russell Sage.
23. Croog, S. H. 1951. Aspects of the cultural background of premarital pregnancies in Denmark. *Soc. Forces*, **30**: 215-219.
24. ————. 1952. Premarital pregnancies in Scandinavia and Finland. *Amer. J. Soc.*, **57**: 358-365. (Cf., Backer, J. E., Comment. *Amer. J. Sociol.*, **58**: 68.)
25. Ellis, A., Doorbar, R. and Johnston, R. 1954. Characteristics of convicted sex offenders. *J. Soc. Psychol.*, **40**: 3-15.
26. England, The Registrar General. 1955. *Statistical Review of England and Wales, Pt. 2, Civil*. London: Her Majesty's Stationery Office.
27. Gebhard, P. B., Pomeroy, W., Martin, C. and Christensen, C. V. 1958. *Pregnancy, Birth and Abortion*. New York: Harper & Bros.
28. Glueck, S. and Glueck, E. 1950. *Unraveling Juvenile Delinquency*. New York: The Commonwealth Fund.
29. Goodwin, J. A. 1888. *Pilgrim Republic*. Boston: Ticknor & Co.
30. Howard, G. E. 1904. *A History of Matrimonial Institutions*. Chicago: Univ. of Chicago Press.
31. Huntington, E. 1938. *Season of Birth*. New York: John Wiley & Sons.
32. Kinsey, A. C., *et al.* 1948. *Sexual Behavior in the Human Male*. Philadelphia: W. B. Saunders Co.
33. ————. 1953. *Sexual Behavior in the Human Female*. Philadelphia: W. B. Saunders Co.
34. Kiser, C. V. and Whelpton, P. K. Social and psychological factors affecting fertility. 1947. *Milbank Mem. Fund Quart.*, **25**: 63-111.
35. LeMasters, E. E. 1957. *Modern Courtship and Marriage*. New York: Macmillan.
36. Lindenfield, F. 1960. A note on social mobility, religiosity, and students' attitudes to-

ward premarital sexual relations. *Amer. Sociol. Rev.*, **25**: 81-84.
37. Locke, H. J. 1951. *Predicting Adjustment in Marriage.* New York: Henry Holt.
38. *New York Times.* December 29, 1949.
39. Patterson, S. H. 1922. Family desertion and non-support. *J. of Delinq.*, **7**: 249-282, 299-333.
40. Pearl, R. 1939. *The Natural History of Population.* New York: Oxford Univ. Press.
41. *Philadelphia Evening Bulletin.* August 7 and 8, October 15, and December 26, 1958.
42. *Philadelphia Inquirer.* October 15 and December 19, 1958.
43. Philadelphia Municipal Court. *Annual Reports.* Especially 1915 to 1918, and 1957.
44. Reiss, I. L. 1956. The double standard in premarital sexual intercourse. *Soc. Forces*, **34**: 224-230.
45. ————. 1957. The treatment of premarital coitus in "marriage and the family" texts. *Soc. Prob.*, **4**: 334-338.
46. Rogers, E. 1935. One hundred juvenile marriages. *Soc. Forces*, **13**: 400-409.
47. Savitz, L., 1960. *Delinquency and Migration.* Philadelphia: Human Relations Commission. (An abstract of a Ph.D. thesis by the same title, Univ. of Penna.)
48. Stouffer, S. A. 1935. Trends in the fertility of Catholics and non-Catholics. *Amer. J. Sociol.*, **41**: 143-166.
49. Stouffer, S. A. and Lazarsfeld, P. F. 1937. *Research Memorandum on the Family in the Depression.* New York: Social Science Research Council.
50. Thomas, J. L. 1949. Some factors involved in the breakdown of Catholic marriage. Unpublished Ph.D. thesis, Univ. of Chicago.
51. ————. 1952. Prediction of success or failure in forced marriages. *Theol. Studies*, **13**: 101-108.
52. ————. 1954. The problem of "forced" marriages. *Soc. Ord.*, **4**: 99-104.
53. ————. 1956. *The American Catholic Family.* Englewood-Cliffs, N. J.: Prentice-Hall, Inc.
54. *Time.* February 13, 1950 (under Religion).
55. *Washington Post.* February 2, 1950, p. 16.
56. Zimmerman, C. C. and Cervantes, L. J. 1956. *Marriage and the Family.* Chicago, Henry Regnery Co.

BIOLOGIC CONCEPTS OF SEX AND REPRODUCTION

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AS A BIOLOGIC CONCEPT, sex may be considered as a comparison of contrasting characteristics in organisms that produce either eggs or sperm. It is not a force to produce these contrasts, but simply the aggregate of genetic, anatomic, physiologic and psychologic qualities that we recognize as maleness or femaleness. Egg and sperm may be produced by a single individual; such cases are known as hermaphrodites. Since some lower animal forms are naturally hermaphroditic, sexuality may relate only to the genetic characteristics of the gametes and omit completely any consideration of somatic variations among individuals. But for most animals, including all the protochordates and chordates, sexuality refers to the composite of genetic, somatic and behavioral contrasts between males and females. The somatic differences involve mostly the reproductive system and various accessory structures, frequently ornamental, that are related somehow to the process of reproduction. Even though sex-specific characteristics may exist that have no apparent association with reproduction, these usually result from the action of hormones of the reproductive system. Examples would include sex-differences in the normal concentration of certain blood constituents or the fact that tolerance to drugs may differ between the two sexes of a single species.

SEX DETERMINATION

Genetic sex is established at fertilization and until differentiation of the gonads during embryonic development of the individual, chromosomal constitution may be considered the sole manifestation of sex. The term *sex determination* is often applied to the establishment of chromosome constitution at the time of fusion of egg and sperm. With each gamete contributing a haploid complement of chromosomes, the fertilization process establishes the diploid chromosome number, characteristic of the species and found in the nuclei of all somatic cells. In the human, for example, the diploid number of 46 chromosomes has now been amply verified (Tjio *et al.*, 1959). In males and females, 44 chromosomes may be classified in 22 pairs, termed autosomes. The remaining two of females are paired also, and are known as the sex chromosomes, symbolized as XX. Males, however, have sex chromosomes that are morphologically distinguishable; one resembles the X chromosome of females and the other is the much smaller Y chromosome. The sex chromosome constitution of the male, therefore, is XY, and it is referred to as the heterogametic sex. Consequently, when chromosomal reduction to the haploid number occurs in the process of sperm formation (spermatogenesis) half of the sperm are endowed with a set of

autosomes and an X chromosome, while the other half contain the 22 autosomes and a Y chromosome. The former may be termed gynosperm and the latter androsperm. Obviously, the female produces only one kind of egg, all carrying the X chromosome; this is the homogametic sex. It is assumed that sex is genetically determined on the basis of a quantitative balance between male-determining and female-determining genes. Although the sex chromosomes are the primary vehicles for sex-determining genes, in certain animal forms autosomal factors may contribute to the quantitative balance that decides sexuality (Goldschmidt, 1955). The "balance" system works so that two doses of the female determiners on the X-chromosomes (XX) overcome the male determiners outside of the X, but one dose (XY) is insufficient for the dominance of female factors. The quantitative balance theory of sex determination emphasizes that male and female sex determiners are present in both sexes, accounting for the fact that in each sex the potentiality for the other sex is present.

Heterogamety and Heterochromosy

Considering the distribution of chromosomes during the genesis of gametes, it is apparent that in species with male heterogamety, as in the human, the chromosomal constitution of the sperm is of major importance in determining sex at fertilization. Efforts have been made to separate androsperm and gynosperm on the basis of supposed differences in physical-chemical properties (Gordon, 1957). Such separation, followed by artificial insemination, could permit the control of sex of offspring. To date, however, confirmed and definitive results have not been achieved. Promising investigations are continuing, utilizing the techniques of electrophoresis (Vesselinovitch, 1960), immunology (Tyler, 1948) and differential centrifugation (Lindahl, 1958). It has been claimed by Shettles (1960) that androsperm and gynosperm of the human can be identified by morphologic characteristics evident under the phase microscope. Future confirmation will be required to establish the validity of this observation. About ten years ago Barr and his co-workers (1949) discovered a previously ignored sexual dimorphism in somatic cell nuclei that permits the identification of male or female tissue. It is possible to identify female tissue by the presence of a characteristic chromatin mass, which is absent or only occasionally seen in male cells. This body, the *sex chromatin mass,* is probably a manifestation of the intermitotic phase of the X chromosomes. There remains some controversy as to its precise origin. However, the study of sex-chromatin has become of considerable importance in diagnosing and classifying cases of human intersexuality (Segal and Nelson, 1957). For this purpose, the terms chromatin-positive and chromatin-negative have been introduced to refer to females and males, respectively.

Primary Sex Differentiation

The sex glands serve the dual function of gamete production and hormone secretion. They originate identically in males and females as undifferentiated primordia consisting of a cortical and medullary region. The cortex is an inductor of female differentiation and the medulla an inductor of male differentiation. In the event of male development the embryonic medulla predominates to form the major part of the testis and

the cortex regresses. Female development is marked by the dominance of the cortex which gives rise to an ovary. Normally, the pathway of differentiation to form testes or ovaries is determined by the genetic sex established at fertilization. Nevertheless, this process can be influenced by non-genetic factors. It has been demonstrated in amphibia, birds and mammals that testes may very well develop in genetic females, if the proper hormonal or physical influence is exerted while the embryonic gonad is still in the indifferent state. Conversely, ovaries may be induced to differentiate in genetic males. The factors that decide the alternatives of testicular or ovarian differentiation may be placed in three groups: *genetic, environmental* and *localized internal agents* (for review, see Witschi, 1957). *Environmental conditions* such as extreme temperatures or delayed fertilization can partly or completely reverse the genetic determination of amphibia (Witschi, 1952). In nature, a striking example of the importance of environmental conditions during differentiation of the gonads is the case of the eel. Sex ratios of eel populations differ greatly in different geographic locales, in spite of the fact that the genetic mechanism for sex inheritance should result in a 50:50 sex ratio. Among certain European eels, females are more prevalent in the higher reaches of rivers, while in the estuaries and coastal seawaters males are more frequent. Also, in the farthest regions of the geographic area of distribution of a species, females tend to predominate. The accumulated facts and supporting experimental evidence suggest that environmental conditions such as temperature and crowding can overcome genetic sex determination and exert a primary influence over sex differentiation (D'Ancona, 1959). External factors do not interfere by changing the genetic constitution. They affect adversely the cortical or medullary inductor systems that operate in the differentiation of the gonad. Among the invertebrates, the influence of external environmental factors on sex differentiation is noted in many species. In *Bonellia,* a gephyrean worm studied by Baltzer (1937), the males are minute and undergo sexual differentiation while parasitically attached to the larger female. Most of the free-swimming larvae which come to rest upon the proboscides of the females differentiate in the male direction; those which settle on the sea bottorm transform into females. Extracts of the proboscis, added to the water in which sexually indifferent larvae are maintained, are effective in encouraging the production of males. In another annelid worm, *Ophryotrocha,* all young individuals are functional males but become females under favorable environmental conditions. Adverse conditions, such as inanition, lack of oxygen, accumulated excretions resulting from overcrowding, cause the female to revert to the male phase (Hartmann and Lewinski, 1938). These examples serve to demonstrate that many of the invertebrates have genetic mechanisms so labile that natural or experimental alterations of the environment may suffice to produce sex reversals.

The role of localized internal factors in sex differentiation becomes evident through an analysis of experimental and naturally-occurring sex reversal in vertebrates. Lillie's (1917) descriptions of different sexed cattle twins illustrate this concept. When the fetal membranes of male and female calf embryos become united in the uterus so that a common blood circulation develops, the female embryo is modified in the male direction,

forming the so-called *free-martin*. So complete is this transformation that the female develops a sterile testis instead of an ovary. Absolute sex-reversal, to the extent of transforming genetic males or females into reproductively functional individuals of the opposite sex has been istration of hormonal susbtances before the embryonic gonad is differentiated. An example is the sex-reversal of *Xenopus* larvae, by Chang and Witschi (1955). If young tadpoles are reared in aquarium water containing small quantities of estrogenic hormones, the expected 50:50 sex ratio does not prevail; instead all larvae become ovary-bearing females. That genetic males are functioning as reproductive females *without alteration of the original male genetic constitution* can be proven by breeding experiments between sex-reversed males and normal males. Since in this species the male is homogametic (XX), 100 per cent of the offspring of such a mating are male. Many species of amphibia have been completely sex-reversed in this fashion. Functional sex reversal may be produced, also, in birds (Miller, 1938). It is entirely reasonable that this could occur in higher vertebrates although it has not yet been achieved experimentally or proven to have occurred spontaneously.

Secondary Sex Differentiation

Differentiation of the accessory sex structures follows the primary differentiation of the gonad and almost without exception, throughout the vertebrate class, these organs are not under direct genetic control but under the influence of secretions from the newly-formed gonads. In the embryo during the indifferent stage, the oviducts (ducts of Muller) and mesonephric ducts (of Wolff) appear in both sexes. The oviduct is the primordium of the Fallopian tubes, uterus and upper vagina. The mesonephric duct gives rise to the epididymis, vas deferens and seminal vesicle. In the male, the oviduct degenerates during the process of secondary sex differentiation, while in the female it is the mesonephric duct that does not persist. External genitalia of each sex develop from bipotential primordia, the urogenital sinus and the genital tubercle, which have the capacity to develop along masculine or feminine lines (for review, see Grumbach and Barr, 1958). *Thus, each embryo possesses the potentiality to develop internal and external genital organs of either sex.* Recent experiments, employing the technique of fetal castration, have elucidated the influence of the fetal gonad on the differentiation of the sex accessory organs. In the absence of gonads, mammalian fetuses will develop female accessory structures, regardless of whether the castrated individual be genetic male or genetic female. (Jost, 1947). If genetic males are deprived of their fetal gonads after the masculinization of the upper portion of the genital duct system has begun, then only the lower regions and the external genitalia are of the feminine type. In this fashion, pseudohermaphrodites can be experimentally produced which possess both male and female genital structures. By unilateral castration, it can be demonstrated that the morphologic inductive capacity of the mammalian fetal testis acts locally to suppress the oviduct and activate the mesonephric duct. Removal of a single fetal testis results in the appearance of a female duct system on the operated side, while male development proceeds on the unmolested side. These experiments of Jost, with rabbit fetuses, have contributed considerably toward the understanding of human pseudohermaphroditism and intersexual-

ity. Parallel experiments of Wolff (1959) in birds reveal the interesting fact that in this group of vertebrates, it is the *ovary* that must be present to suppress the tendency for masculine differentiation to occur. The principles regarding the inductive role of the gonad in the differentiation of the accessory sex organs are identical. Why the agonadal condition results in masculinization in one group of vertebrates and in another brings about feminization is problematical. In all likelihood, the explanation is linked to the fact that females are the homogametic sex in mammals while male birds are homogametic. How this genetic factor acts in secondary sex differentiation is unknown.

Control of Adult Secondary Sex Characteristics

The establishment and maintenance of sexual patterns, both morphologic and behavioral, usually involve the activity of coordinated hormonal interactions. Some sexual dimorphisms, particularly among birds, are not hormonally controlled but are determined by genetic constitution directly. This is true of normal sex differences in plumage of a number of avian species. In the English sparrow, neither removal of the gonad nor hormone injection has any noticeable effect on plumage dimorphism (Keck, 1934). An intermediate type is represented by the pheasant in which full development of sexually characteristic plumage is dependent upon simultaneous actions of both genetic and hormonal factors (Danforth, 1935).

In contrast to those instances, mainly in birds, of direct genetic control, is the vast majority of behavioral and morphologic expressions of sexuality which are established and controlled by hormonal mechanisms. The range of hormonally controlled sexual characteristics in vertebrates extends from exotic courtship rites of salamanders to such majestic ornaments as the antlers of the deer or the mane of the lion. Almost all of these sex-specific features are under the influence of steroid hormones, produced by the sex glands. However, exceptional situations have been described in which there is a direct influence of protein hormones from the pituitary on secondary sex characteristics. In several generations of African finches, the male bird assumes a bright nuptial plumage at the onset of the breeding season. He maintains this adornment for two or three months and then, after molting, dons the hen-type plumage, a constant characteristic of the female. This plumage change coincides with the cyclic change of the gonads from the quiescent to the breeding stage. Castrated males, however, continue to develop the colored plumage rhythmically. This indicates that feather pigmentation during the male phase of the plumage cycle is not controlled by the gonad. It has been established that a pituitary hormone, luteinizing hormone, controls this secondary sex characteristic (Witschi 1936). This represents an unusual case, perhaps an evolutionary transition, for almost always pituitary hormones direct their action toward endocrine glands and it is the secretions of the target glands that influence the rest of the body soma.

As each vertebrate organism approaches the stage of gonadal maturation, greater and greater contrast between male and female becomes apparent. Male guppies develop a gonopod; thumb-pads appear on the digits of male frogs. In the male turtle, *Pseudemys elegans,* the three middle foreclaws, which are used to stimulate the female during courtship, begin to elongate. Voice changes, not unlike those of young

boys approaching puberty, become apparent in such diversified vertebrates as the leopard frog, tree toad, prairie chicken, domestic duck and the male mink. With the onset of gonadal function in the male Virginia deer, antler growth begins. By the time these appendages are needed for fighting during courtship, they have shed the velvet and grown hard in response to increased production of testis hormones. The boar's tusks, the bull's horn and crest, the goat's odor gland, the ram's horns and the rooster's comb and spurs are all well-known secondary sex characteristics that respond to the action of testicular hormones (for review, see Beach, 1949). Females are equally dependent upon hormonal stimuli from the gonads for the development of sex-contrasting characteristics. The thread-like oviducts of the female frog enlarge to fill most of the abdominal cavity as the first breeding season approaches. The female opossum's vicious resentment of the male's advances is replaced by docile acceptance as ovarian function becomes established. The female clawed-toad, *Xenopus,* undistinguishable from males as young juveniles, responds to ovarian hormone production by a typically feminine growth pattern just as the awakened ovary stimulates the developing of feminine contours in the human female at puberty.

Sex Cycles: Neural Influence on Sexuality

In many vertebrates, the majority of sex-specific characters appear and regress seasonally at the time of the breeding season, while others, including all primates studied, maintain most sexual features from the time of puberty until the onset of gonadal senility. These differences depend on events controlling the function of the gonads. All lower vertebrates, most birds and some wild mammalian species, are seasonal breeders. Ovaries and testes regress each year at the end of the breeding season. Consequently, the hormone-sensitive secondary-sex characters become quiescent, ready to be re-awakened the following spring. The cottontail rabbit is representative of this group. The testes, for example, return to a completely immature condition each autumn. In midwinter, they begin to grow and in early spring reach fifty to a hundred times their weight in the inactive phase (Witschi, 1956). Correspondingly, sex structures such as the seminal vesicles and prostate glands, as well as sexual behavior patterns, regress and develop each year, under the influence of the falling and rising tide of testicular hormones. Seasonal breeders exhibit an annual ovarian quiescence, also. The ovary of starlings increases nearly thirty-fold in weight from early winter to spring (Witschi, 1956). Ovarian hormones are not produced during the inactive phase but gradually reappear each year as ovarian growth is initiated. Consequently, oviduct development and other factors necessary for successful reproductive function are provided with the required hormonal stimulus in time for the breeding season.

The rhythmic character of gonadal function in both sexes of seasonal breeders is the result of concomitant waves of anterior pituitary production of gonad-stimulating hormones (gonadotrophins). In the male cottontail rabbit whose testicular history was described above, the gonadotrophin content of the pituitary increases over the inactive phase by 600 per cent at the opening of the breeding season (Elder and Finerty, 1943). The importance of seasonal changes in length of daylight in controlling these cyclic

peaks of gonadotrophin production has been well established for many species. Brook trout, for example, which usually spawn in December, will produce offspring in August if the light-dark rhythm is appropriately manipulated (Hoover and Hubbard, 1937). Similarly, ovarian development, consequent to the awakening of gonadotrophin production, may be stimulated in female sparrows during the winter by increasing the light ratio (Riley and Witschi, 1938). Nevertheless, light is not the only cause for the cyclic nature of the pituitary; all factors are not completely understood. It is apparent, however, that these factors, including light, operate through the neural system — the hypothalamus or higher brain centers—in exerting their influence on the pituitary. Thus, the control of gonadotrophin production and release exemplifies a neuro-endocrine mechanism which links the two important coordinating systems of the body. It is evident that differences in sex cycles among mammalian females simply reflect different degrees of spontaneity in the function of neuro-endocrine pathways controlling the production and release of gonadotrophic hormones. Monestrus, seasonal breeders like the cottontail rabbit or ferret, in response to photostimulation in the spring, elaborate the gonadotrophic hormones which develop ovarian follicles and stimulate the ovary to produce estrogenic hormones. The ovary may remain in this condition for the remainder of the breeding season. No further gonadotrophin-induced events occur spontaneously. When the neural stimulus initiated by the mating act reaches the pituitary, the necessary gonadotrophins for ovulation are released, and the ovary responds to this hormonal stimulus by releasing eggs from the matured follicles and by switching its hormone production from the sexual-preparedness type (estrogens, mainly) to the pregnancy-preparedness (progesterone, mainly) type. The mating stimulus activates, also, the release of the gonadotrophic hormone required to maintain the ovary as a progesterone-producer. This sequence is the basic pattern of gonadotrophin production for the complete manifestation of gonad-controlled sexuality in all mammalian females. Differences in sex-cycle type reflect differences in the extent to which neural stimuli for the release of the various gonadotrophins occur spontaneously, without the requirement of the neurogenic influence of mating. The neuro-endocrine pathways of polyestrus breeders, like the rat or mouse, bring about the release of both follicle-stimulating and ovulation-inducing gonadotrophins in repetitive sequence. Thus, spontaneous ovulation becomes a regular event in the reproductive cycle of these animals. However, like the rabbit, they require the stimulus of mating to activate the neural pathways that control the release of gonadotrophins to maintain progesterone production by the ovary. Progestational breeders (cows and guinea pigs) and menstrual breeders (humans and other primates) include even the latter event among the spontaneous occurrences of the reproduction cycle, accounting for the prolonged, post-ovulatory phase of their cycles.

Neural control of gonadotrophin release may be considered the key mechanism through which "maleness" and "femaleness" become contrasted in the sex hormone activity of individuals of many species (Segal and Johnson, 1959). Except for seasonal breeders, males tend to release at a steady rate the full complement of gonadotrophins necessary for complete gonad function—both gamete

and hormone production. Even seasonal breeders follow this rule during the reproduction season each year. Females of all species, however, exhibit a cyclic gonadotrophin activity which controls the observed temporal variations in ovarian function and almost all secondary sex characteristics, including sexual receptivity. In many ungulates, a parallelism exists between the duration of heat and the relative preponderance of follicle-stimulating hormone in the pituitary (Asdell, 1946). Normally this favors a desirable synchronization between the time of maximal sexual receptivity and the spontaneous release of ovulation-inducing gonadotrophins.

Although it is clear that neural control of gonadotrophin release as described for lower mammals applies, also, to the human, almost nothing is known of the mechanisms through which psychologic factors influencing sexuality. It would be tempting to suppose that the gonadotrophin-release mechanism of the neural system is ultimately the basic *modus operandi*, but this explanation fits only some of the observed facts and not others. Psychologic pseudo-pregnancy in the human could be explained on this basis, but in psychic infertility, a far more prevalent condition, gonadotrophin function appears to be completely normal. Similarly, abnormal conditions of sexual performance, including frigidity, impotence and nymphomania, do not appear to be correlated with abnormal gonadotrophin function. It may be pointed out, however, that our present tests for gonadotrophin function are far from precise, and, with the development of better methods, our current concepts may undergo considerable change.

REFERENCES

ASDELL, S. A. 1946. *Patterns of Mammalian Reproduction.* Comstock Publishing Co., Ithaca, N. Y.

BALTZER, F. 1937. Entwicklungsphysiologische Analyse der Intersexulitat. *Rev. Suisse Zool.* **44:** 331.

BARR, M. L. and BERTRAM, E. G. 1949. A morphological distinction between neurones of the male and female, and the behavior of the nucleolar satellites during accelerated nucleoprotein synthesis. *Nature* **163:**676.

BEACH, FRANK A. 1949. *Hormones and Behavior.* Paul Hoeber, Inc., New York. Chapter 10: 148.

CHANG, C. Y. and WITSCHI, EMIL. 1955. Breeding of sex-reversed males of *Xenopus laevis* Daudin. *Proc. Soc. Exper. Biol. and Med.* **89:**150.

D'ANCONA, UMBERTO. 1959. Distribution of the sexes and environmental influence in the European eel. *Archives d'Anat. Micros. et Morph. Experim.* **48**bis:61.

DANFORTH, C. H. 1935. Different potentialities of male and female skin in Reeves pheasants. *Proc. Soc. Exp. Biol. and Med.* **33:**291.

ELDER, J. H. and FINERTY, J. C. 1943. Gonadotropic activity of the pituitary gland in relation to the seasonal sexual cycle of the cottontail rabbit (*Sylvilagus floridanus* Mearnsi) *Anat. Record* **85:**1.

GOLDSCHMIDT, RICHARD B. 1955. *Theoretical Genetics.* Univ. of California Press, Berkeley, Part IV:424.

GORDAN, M. J. 1957. Control of sex ratios in rabbits by electrophoresis of spermatozoa. *Proc. Nat. Acad. Sciences* **43:**913.

GRUMBACH, MELVIN M. and BARR, M. L. 1958. Cytological tests of chromosomal sex in relation to sexual abnormalities in man. *Recent Prog. Hormone Research* **14:**255.

HARTMANN, M. and LEWINSKI, G. VON. 1938. Untersuchungen uber die Geschlechtsbestimmung and Geschlectsumwandlung von *Ophryotrocha puerilis. Zool. Jahrb. Abt. Allg. Zool. u. Physiol. Tiere.* **58:**551.

HOOVER, E. E. and HUBBARD, H. F. 1937. Modification of the sexual cycle of trout by control of light. *Copeia* **4:**206

JOST, ALFRED. 1947. Recherches sur la Différenciation Sexuelle de l'Embryon de Lapin. III. Rôle des Gonades Foetales dans la Différenciation Sexuelle Somatique. *Arch. d'Anat. Micr. et de Morphol. Exper.* **36:** 271.

KECK, W. N. 1934. The control of the secondary sex characters in the English sparrow, *Passer domesticus* (Linnaeus). *Jour. Exp. Zool.* **67:**315.

LILLIE, F. R. 1917. The free martin: A study of the action of sex hormones in the foetal life of cattle. *J. Exper. Zool.* **23:**371.

LINDAHL, PER ERIK. 1958 Separation of bull spermatozoa carrying X- and Y-chromosomes by counterstreaming centrifugation. *Acta Agricultural Scandinavica* **8:**3.

Miller, R. A. 1938. Spermatogenesis in a sex-reversed female and in normal males of the domestic fowl, *Gallus domesticus*. *Anat. Record* **70**:155.

Riley, G. M. and Witschi, E. 1938. Comparative effects of light stimulation and administration of gonadotropic harmones on female sparrows. *Endocrinology* **23**:618.

Segal, Sheldon J. and Nelson, W. O. 1957. Developmental aspects of human hermaphroditism: The significance of sex chromatin patterns. *Jour. of Clin. Endocrin. and Metab.* **17**:676.

Segal, Sheldon J. and Johnson, D. C. 1959. Induction influence of steroid hormones on the neural system: Ovulation controlling mechanisms. *Arch. d'Anat. Micr. et de Morphol. Exper.* **48**bis:261.

Shettles, Landrum B. 1960. Nuclear morphology of human spermatozoa. *Medical Circle Bulletin* **7**:8.

Tjio, J. H., Puck, T. T. and Robinson, A. 1959. The somatic chromosomal constitution of some human subjects with genetic defects. *Proc. Nat. Acad. Sciences* **45**:1008.

Tyler, Albert. 1948. Fertilization and immunity. *Physiol. Reviews.* **28**:180.

Vesselinovitsch S. D. 1960. Electrophoresis of spermatozoa and sex control. *The Cornell Veterinarian* **60**:326.

Witschi, Emil. 1936. Effects of gonadotropic and estrogenic hormones on regenerating feathers of weaver finches (*Pyromelana Franciscana*), *Proc. Soc. Exp. Biol. and Med.* **35**: 484.

————. 1952. Overripeness of the egg as a cause of twinning and teratogenesis. *Cancer Research* **12**:763.

————. 1956. *Development of Vertebrates.* 1st Edition, Philadelphia, W. B. Saunders Co.

————. 1957. The inductor theory of sex differentiation. *Jour. of the Faculty of Science,* Hokkaido University, Japan, Series VI, **13**:428.

Wolff, Etienne. 1959. Endocrine Function of the Gonad in Developing Vertebrates in: *Comparative Endocrinology* (ed. A. Gorbman) John Wiley & Sons, New York, Chapter **35**: 568.

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. . . The progress in modern experimental biology during the past quarter century has been so vast, so penetrating, and so exciting that it would require a battery of experts and a set of books to do it justice. As a single example, is it not a striking fact that only for a very few years has science realized the sexual nature of the reproduction process in bacteria and the interchange of genetic material between virus strains? . . . It has nevertheless been the physical sciences which have, to a large extent at least, produced the great modern armament of biological and medical research equipment. . . . For as science moves forward through an array of problems of increasing complexity, the physical sciences, dealing as they have for so long a time with problems of simplicity, have quite naturally had the great early successes, and have in this process produced many tools of thought and experiment which can now be used to drive deeper into biological complexity. Furthermore the trend of modern biology is toward an ever finer scale of dimension. The classical morphologist or systematist used his eyes—the bacteriologist, the ordinary optical microscope. But modern biology is deeply concerned with structure and events on a much more refined scale. This push into an ever-smaller world of analysis and explanation can be symbolized by the statement that there is very likely no more basic or central problem of modern biology than that of the detailed arrangement of the millions of individual atoms within the DNA of chromosomes.

The physical sciences have also been engaging in a drive toward smallness, and for reasons which we now recognize as obvious, they are ahead of the biologist. Whereas the latter is, so to speak, inside the cell and in extreme cases inside huge macromolecules of protein, the physicist is inside the nucleus, some ten orders of magnitude smaller than a cell. It is therefore not surprising that the physical sciences have developed a whole range of devices and experimental procedures which are now becoming a normal and accustomed part of biological experimentation.

Many of these devices and procedures can be classified under two headings—new and more powerful ways of *separating*, and new and more powerful ways of *seeing*. Here both of the words *separating* and *seeing* are used in a rather extended sense. . . .

If biology presents, for the most part, problems of organized complexity, then one must expect any piece of living matter to contain a vast number of individual substances, all tangled together in an intimate interrelation. But this kind of complexity remains a mystery until one can, in some way, untangle the mess, separate out parts that are themselves homogeneous, and find out what these separate parts are. So *separation* is a basic procedure in attacking biological problems. . . .

Thus first in our list of newer methods

*Extracts by permission from *The President's Review* (Including A Quarter Century in the Natural Sciences) by Warren Weaver from *The Rockefeller Foundation Annual Report*, 1958, New York.

of separation we should note the improvements in the ancient procedure of screening. Modern science and technology now makes available cellulose ester filters of remarkable porosity (up to 80 or even 85 per cent) with a range of carefully controlled pore sizes. . . . The centrifuge, familiar to the dairyman who separates the cream from the milk by utilizing their difference in density, has been developed over the period under review into a most powerful tool for separating out the various component particles, differing in density, which are suspended in or go to make up a liquid. . . . One . . . method, useful both for identification and separating, is the modern procedure of electrophoresis. The basic principle is an old one, and is due to observations made in 1809 by the Russian physicist F. F. Reuss. But modern development dates only from the mid-thirties, and is due very largely to the brilliant researches of the Swedish physical biochemist, Arne W. K. Tiselius. . . .

An extraordinarily useful and interesting set of procedures which involve identification, although normally not separation, depends upon the obvious fact that tiny experimental creatures such as bacteria or fungi are available in large, willing and rapidly replenished numbers, and upon the further not at all obvious fact that they have chemical skills which no human chemist possesses.

If, for example, one studies a large number of micro-organisms (the red bread mold *Neurospora crassa* is a now classic example, although the method is only about twenty years old) some of these turn out to be *mutant* strains, this meaning that one of the creature's genes has become altered. According to the present view, certain genes are responsible for the possession by the organism of certain enzyme systems; and in some instances at least, one gene controls the enzyme. If this gene is altered, the mutant strain of the fungus would lack that particular enzyme.

Now this tiny and lowly creature, in order to live, carries out a great many chemical tasks. It can take a number of relatively simple chemical substances and link them together into some large and more complex substance which it requires; or it can take large and complex material which is unusable in its complete form, and split it up into useful parts. Each one of these individual steps of joining or splitting is activated by one special enzyme. Whereas a human organic chemist can carry out multitudes of chemical reactions, an enzyme system (generally speaking) can carry out only one specific chemical operation. But it may be a job which *no* human chemist can do; and it is, moreover, easy to exploit the fact that each enzyme is such a specialist.

For suppose one has produced (by irradiating with X-rays, for example) a lot of mutant strains of *Neurospora*. Suppose these have been sorted out, and a strain isolated which cannot live unless the food furnished to it contains a supply of, say, the B vitamin thiamine, whereas the normal strains do not require thiamine since they possess an enzyme which is a specialist at making thiamine from other material.

This thiamine-requiring mutant strain (which incidentally breeds true so that it can be maintained in the laboratory) is now ready to go to work for the scientist. If he has a sample of mixed-up material, and wants to know whether or not it contains thiamine, he merely introduces the sample into a thiamine-lacking food supply and offers it to the mutant strain. If the fungus prospers, then the mess contained thiamine; otherwise not.

A single example of this sort is likely to sound like a *tour de force;* but actually there are numerous and highly useful ramifications of this general technique. . . .

Before closing this section on separating and identifying we must pay trib-

ute to one of the most dramatic successes of this period—the development of chromotography. This is in fact a kind of screening procedure, so that in a very broad sense we return to the topic which started this section. But the screening, here, does not depend on size. . . . This amazing discovery was used only a few times between 1906 and the beginning date of this review; but chromatography, in its present greatly improved forms, is now one of the most powerful tools in the hands of the chemically minded biologist. It promptly turned out that this method of separation, almost mysterious in its simplicity and its ability to deal with complex mixtures which defy ordinary chemical means, was not restricted to colored dyes, but could be used for a wide range of materials. . . .

"It has been said by many, notably the eminent nineteenth century physiologist Claude Bernard, . . . that progress in science frequently depends upon the development of good methods. Chromatography furnishes a vivid example of the truth of this statement. . . ."

Even more spectacular than the new ways to separate are the developments which give the biologist new ways of seeing; and among these the most obvious and also one of the most important is to be found in the modern improvements in microscopy . . . the great advance in resolution—which is the technical term for the capacity of a seeing device to discriminate fine detail—came from the development of the electron microscope. Utilizing the fact that electrons behave like light of wave length less than one-thousandth that of ordinary light, instruments have been developed which can handle detail down to a ten-millionth of a centimeter. This whole instrumental development has occurred over the period here under review. . . . There are a variety of other devices which have improved the scientist's capacity to see. Several of these are modifications of the older optical microscope.

The reader, more than once as he has read thus far, may well have wondered if modern biology no longer is concerned with the classical fields of anatomy, physiology, genetics, embryology, neurology, etc.; if it is now so preoccupied with tools and techniques that it is not interested in the conceptual aspects of the great problems of biology; if it no longer is mystified as to how differentiation, growth, decay, and death occur; if it no longer hopes to get fuller understanding of instinct, of learning, of behavior in general.

The reply, of course, is that these remain great central concerns of the biologist. What has changed is that these problems are now being approched not only from *above*, with the broad view of the natural philosopher who scans the whole living world, but also from *underneath*, by the quantitative analyst who measures the underlying facts. . . .

The most biological of biologists should welcome this newer orientation, not as a replacement for a more naturalistic attitude, but as a supplement to it. For the fact is that biology, for all the richness of its collection of bits and pieces of information about nature, has been singularly weak in discovering great principles around which myriads of otherwise isolated facts can cluster in a meaningful and unifying way. In the case of the physical sciences one can write down a substantial number of "great laws," applicable universally. . . . For biology, one starts off bravely with the concepts of evolution, the universality of the cell as a unity of life, and the central principles of genetics and then rather lamely turns to discussion of individual problems rather than broad pronouncement. . . .

There is, however, real reason to expect that biology is now in the process of establishing the kind of base of analytical and often quantitative fact which can lead to and can sustain a much

broader theoretical base than has as yet been available to the life sciences.

It is of the most characteristic significance, relative to the movements in modern biology, that in many instances the underlying facts are now being successfully explored at the submicroscopic scale of molecular and even atomic dimensions. Biological ultrastructure has become a recognized and rich field. For several years now a term has been used, seriously and in an operational sense, which in 1932 would have been used only with imagination and hope—*molecular biology*.

A great deal of the information about biological material at this new scale of smallness consists of knowledge about *structure*. This knowledge has to a great extent been made possible by the procedures and instruments which have been reviewed in the preceding sections. . . . When an organic chemist says that he understands the structure of a molecule, he means that he knows, about that structure, the things which enable *him* to deal usefully with it. This means, in part, that he has it classified in relation to a lot of other compounds which he also understands; and that he therefore has a very good idea of how it will behave under a lot of chemical circumstances. It also means that he knows how to go about modifying the compound, and perhaps even knows how to synthesize it. This, however, is not at all what the physicist, in particular the X-ray crystallographer, means when he says that *he* knows the structure of a molecule, . . .

The organic chemist can often carry out purely chemical studies which give him what he calls the full stereochemical structure. But there are instances in which he finds it awkward or impossible to get this information by chemical means. He is then glad to accept the three-dimensional assistance of the X-ray crystallographer.

It should be no surprise that the X-ray crystallographer has not, as yet, been able to give by his methods the location of each of the hundreds of atoms in the insulin molecule. Crystallographic studies have been made of insulin—or more strictly, of two insulin derivations, and the point has now been reached at which the chemical studies and the crystallographic studies are progressing together, each aiding the other.

That sort of collaboration between the chemist and the crystallographer is very characteristic of the present state of structure studies. In the case of nucleic acid studies, for example, the organic chemist went as far as he could when he determined the precise nature of the individual nucleotide units and showed how they were joined together through the phosphate groups. He then had achieved his goal of chemical and stereochemical knowledge of the units and their mode of linkage. It remained for the X-ray crystallographer, basing his deductions on *physical measurements* but interpreting them, of course, in the light of all the chemical data, to deduce and prove the two-stranded helical structure of the DNA molecule. . . .

The most spectacular of the large molecule structure determinations, and surely one of the most basic interest to biology, is that of deoxyribonucleic acid, better known by its short name, DNA. The great interest in this substance results from the fact that it is this long chain molecule which, on all present evidence, constitutes the naked genetic material in every cell . . . there are two intertwined helices, formed of alternating phosphate and pentose sugar groups, linked together with side groups, or bases. There are (at least) four kinds of these bases, of which two, adenine and guanine, are purines, while the other two, cytosine and thymine, are pyrimidines. When guanine is attached to one helix at a certain point, it always pairs with cytosine on the other helix; and similarly adenine always pairs with thymine. Thus the sequence of bases on one

helix determines the sequence on the other. But the over-all sequence of bases, as found on one molecule of DNA, is by no means the same as that to be found on another molecule, at least unless these two come out of the same living organism. For it is precisely the sequence of these bases which is, by the present view, supposed to contain—and at duplication to pass on—genetic information.

Thus it seems very likely that this beautiful helical molecule, whose long chain pieces inside cells have molecular weights in the millions, is the really critical link between chemistry and biology. It is a pure chemical; but there is strong reason to believe that it is the special chemical which possesses two capabilities necessary for life—the capability of causing itself to be duplicated, and the capability of storing and passing on, to the next generation, a vast amount of genetic information.

A single chromosome of a cell is now thought to consist of about ten million turns of DNA, and there is evidence that what we normally call a gene corresponds to only a few base-pairs along the double helix.

If indeed the genetic constitution of an organism depends fundamentally upon the order along one of the two DNA helices of the four bases A (adenine), G (guanine), C (cytosine), and T (thymine), then at a single base point the question is: which one of the letters A, G, C, or T is to be written down. This requires two simple either-or choices; that is, shall we pick a purine or a pyrimidine, and having settled that, shall we pick the first or the second of the kind? In the language of modern information theory, in which one "bit" of information corresponds to a single either-or or yes-no choice, one would say that it requires two bits of information to decide upon a single one of the chemical cross-links between the two DNA helices: and since there are roughly nine cross-links per turn, a chromosome has something of the order of one hundred million of these cross-links, each of which requires for its specification two bits of information.

We all know, from playing twenty questions, that it is usually possible to single one out of a vast array of possibilities by asking "yes or no?" only twenty times. A chromosome is able, so to speak, to answer such a yes-or-no question some two hundred million times, which corresponds roughly to the total information stored in about one thousand large textbooks.

How DNA, this master chemical of life, duplicates itself, how the genetic information is coded on to the sequence of bases, and how it is read off, are massive questions for the future.

A large part of the credit for this DNA structure story goes to J. D. Watson and F. H. Crick. But, as they have been the first to emphasize, they utilized the superb X-ray diffraction data of M. H. F. Wilkins, Rosalind Franklin, and their co-workers at King's College, London; the basic structural concept of the α-helix which owes so much to Pauling and Corey and to various other scientists back to the pioneer ideas of Astbury; and a mass of essential knowledge built up, step by patient step, by the various organic and biochemists who have worked on nucleic acids. This is a proud example of the fact that it is, after all, within the capabilities of men to deal successfully with organized complexity.

In this brief sketch we have by no means surveyed the entire range of structure studies. Much as we now know, it remains a startling challenge that it has as yet not been possible to determine the complete structure of a single protein. "The proteins, as the name implies, are of first importance in the structure of living matter. No living cell is without them, and any discussion of biological ultrastructure must inevitably start with a consideration of the structure of the proteins." . . .

We are, at this moment, just on the threshold of what should be a quite new era in biology, in that we are just now gaining the first knowledge of the three-dimensional structure of a protein. . . . At the present time it seems most hopeful that we will, over the next decade or so, have deeper and much more extensive and explicit information about protein structure; and that this new information will open vast new opportunities for understanding human health and disease. This new knowledge should contribute in a most significant way to certain of the large medical problems which now confront our society, such as the degenerative diseases of later life, circulatory and cardiac disorders, mental abnormalities, as well as certain less acute but widespread and sometimes disabling handicaps such as allergies. Deeper knowledge of protein structure should permit an understanding of enzyme action, with all that this implies. It will open new vistas in genetics, both in the area of urgent human problems and in the universally important area of world-wide food production. In addition to these tangible benefits, moreover, such advances in a broader understanding of the living world would form, from every intellectual and aesthetic point of view, a worthy and satisfying response of man to the challenge of nature.

For centuries it has been considered that physical nature is orderly, that it is subject to discoverable laws, and that it may be brought under a considerable degree of control through the study of its problems of simplicity and its problems of disorganized complexity. But it has not only been recognized that the phenomena of life present problems of organized complexity; it has also been considered by many that these phenomena of life, are, in some dark and foreboding way, irrational. Indeed, some have gone even further, and have believed that vital phenomena are not only inaccessible to scientific investigation, but are improper and impious objects of any such attempt. This is an old attitude, which centuries ago forced the Italian anatomists to steal corpses in order to carry out their studies.

Even during the magnificent progress made in the last century by medical sciences, there continued the attitude that certain gross and relatively simple disorders of man were analyzable and curable; but that man as a conceiving, childbearing, thinking, remembering, behaving, growing, and finally dying organism presented problems that were in large part outside the range of rational analysis. This last quarter century has seen a considerable reversal of this view.

We can be well satisfied if this Program in Experimental Biology of the Rockefeller Foundation has helped in a small way to demonstrate that the living world, in its most intimate details, exhibits discoverable rationality and orderly beauty; and that the tools of science are just as effective here as they have proved to be in the purely physical world. Indeed one no longer wishes to insist that man is alien to the universe in which he exists. It involves no belittlement of his higher self to recognize that his body is brother to the molecule and the star.

Book Reviews

RADIATION, GENES, AND MAN: Bruce Wallace and Th. Dobzhansky, Henry Holt and Co., N. Y., 1959, 205 pp. $3.50.

The task assumed by this book is to familiarize the reader with significant aspects of that complex, even portentous, problem of our time, the effects on descendant individuals and populations of a likely increasing per capita exposure of the human hereditary material to ionizing radiation. To a very great extent it succeeds in that task, as we might expect from authors such as Wallace and Dobzhansky.

Because of the authors and their subject, one approaches the book with pleasurable anticipation. This soon becomes appreciation, at least to one reader, when it is noted in the preface that "Probably the most important fact concerning the issue is that the data, evidence, and information on which, and only on which, conclusions should rest are as yet wholly inadequate. . . . We intend, on the contrary, to stress the need—indeed, the urgency—of further research on the genetics of populations and on radiation genetics." This is what the authors do, stressing in many places in the text those areas where existing knowledge is at a paucity and where implications from current data must be regarded as tentative.

Reading this book can be a rewarding experience. The introductory chapters present pertinent facts of genetics and physics which are to serve as a background for the developing discussion. The general reader will find brief but often stimulating comment on matters as individual variation, interrelation of genotype and environment, chromosomal replication, radiation-induced mutation, mutation and evolutionary plasticity, concepts of genetic equilibrium, genetic load and genetic death in populations. But it will require a sturdy effort at times to work through the portions of the volume concerned with the genetic structure of natural populations and the impact of mutation upon populations.

Many books, however admirable, have a few spots which might be viewed quizzically. It may be observed that the section on meiosis is thin, the retrospective study of Macht and Lawrence, weakly designed and controlled, is cited as an instance of a significant effect of radiation in a human sample, and a mechanistic concept of genetic equilibrium is once again illustrated by the inevitable rate of inflow and outflow of water into and out of containers. I wonder why the term *somatic* appears neither in the glossary nor the index, and I would question whether we know very much about the "doubling dose for leukemia."

What is the destiny of mutant genes when introduced into a population and what is the impact of such mutations on the population? These are perhaps the core questions and the responses, even by eminent geneticists, are not always in agreement. Differing assessments are discussed with fairness and at length by Wallace and Dobzhansky. Some hold that equilibrium does not obtain, in technologically advanced nations especially, with more mutations, the overwhelming majority detrimental to vigor and mentality, arising in each generation than the number of mutations lost

by genetically handicapped persons failing to reproduce (genetic deaths). Others direct attention to the fact that there are adaptively ambivalent mutations which yield impaired viability when homozygous and yet produce increased vigor (heterosis) when heterozygous. Heterozygosity can confer selective advantage or selective disadvantage on carriers. This is surely a vital research area.

The total social impact of even a slight rise in mutation rate can be only imprecisely evaluated at this time. One may expect from such a rise an increase, manifested in different ways, in the net store of human unhappiness. The conservative approach would be to control those sources likely to increase the rate while the tempo of research in many areas is heightened.

The reviewer has recommended this book to undergraduate students who have had some training in biology and to physician and dentist friends willing to devote a little time and effort for some stimulating and profitable reading. Many ought be attracted to this volume. It will give them an appreciation of the background, the limitations, and the complexities attending a vital human problem, thereby achieving the purpose and hopes of the authors.

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Human Heredity: Ashley Montagu. World Publishing Company, Cleveland and New York, 1959. 397 pp. $5.00.

In recent years the notoriety given to the genetic effects of atomic radiation and the award of the Nobel prize to geneticists have made the general public aware of and interested in the science of genetics and its applications in human life and affairs. It is actually surprising that we have not been flooded by all sorts of publications on the subject such as those which follow spectacular events. This is both fortunate and unfortunate. Fortunate, because the genetic facts have been spared the distortion which they might undergo under such circumstances; and unfortunate because there is a serious need to present genetics to the general public soberly and accurately. The new book "Human Heredity" by Dr. Montagu raises high hopes that it might fill this need. It is described on the cover as "A lucid introduction, presenting the principles of inheritance in the light of the most recently discovered scientific facts . . ." Dr. Montagu, indeed, presents an impressive amount of newly acquired information, including the structure of DNA, chromosomal aberrations in man, and paramutations. He branches extensively into sociology and anthropology. The last chapters, "Heredity and Blood," "What Do We Do About Heredity?" and "The Bomb, Radiation and Heredity," are very well written. Unfortunately, the basic material is presented in such a choppy and inaccurate manner that it may confuse and at times misinform the earnest layman who comes into contact with genetics for the first time.

The basic principles of heredity are dispensed with in a few pages and in a far from clear manner. For example, after stating the first Mendelian law, that "in the zygote the paired genes . . . do not blend but retain their individuality and segregate unaffected by each other . . .," Dr. Montagu proceeds to illustrate the law with an example of blending inheritance. What follows fares no bet-

ter. In fact, one does not get an understanding of how heredity works until some examples are worked out in the second part of the book, beginning on page 223. In the meantime such essential terms as carrier, crossing over, penetrance, expressivity, polygenes, non-disjunction, linkage, adaptive value and others are encountered in the text undefined. Most of them can be looked up in an appended adequate glossary.

Then Dr. Montagu embarks upon a discussion of environmental factors which influence pre- and post-natal development of man and which takes up almost half the space of the book. Some sections, such as those on maternal age, parity, sensitization and nutritional effects come off rather well. But when the influence of such poorly understood factors as drugs, emotional factors, the importance of mothering, and crime is attempted, the discussion often degenerates into idle and unprofitable speculation and is apt to create wrong impressions.

In the last part of the book, which he calls "The Family Album," Dr. Montagu tries to illustrate what he has been talking about with anthropological traits about most of which little is known genetically: skin color, sacral spots, hair and eye color, eyebrows, eyelashes, whorls and cowlicks, and the various bones of the face. An inexcusable omission here is the lack of examples and discussion of representative inherited childhood diseases and adult chronic and degenerative conditions, many of which are of considerable interest to the public. Instead there is an appendix with a long listing of inherited disorders "designed to give the reader some idea of the kinds of disorders that are largely determined by genetic factors. . . ." This, too, is often vague and misleading.

There is an abundance of inaccurate, confusing and at times downright silly statements scattered throughout the book. On page 174 we are informed that "the female possesses two complete X chromosomes and the male possesses only one. It is this difference which endows the female with that biological superiority which enables her to resist the assaults and insults of the environment so much more effectively than the male." On pp. 191-92 manic-depressive psychosis and Huntington's chorea are described as traits due to recessive genes which are expressed more frequently in the female. On p. 254 shortness is described to be "rather more dominant than tallness." And on p. 264, we find this gem, "So far as I know, no one has studied the inheritance of the sinuses of the head. . . . I suspect that when the full story is in, it will be found that large sinuses are inherited as dominants of one kind or another, and that small ones are inherited as recessives."

The book admittedly has many good sections, one of which is an up-to-date list of genetic counseling centers in the United States and Canada. But I am afraid that it is far from a "lucid introduction" to genetics for the general public. It may well prove to be the opposite.

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SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY: Vol. V. P. K. Whelpton and Clyde V. Kiser, Editors, New York: Milbank Memorial Fund, 1958. Pp. 1087 to 1372. $1.00 (paper).

In an effort to learn as much as possible about the social and psychological factors affecting family planning and the level of the birth rate, a detailed survey

of a sample of the Indianapolis population was carried out between April 1941 and January 1942. Over the next several years the results of this survey were published as individual articles by various authors in the *Milbank Memorial Fund Quarterly*. Beginning in 1946 with Volume One, groups of these articles were reproduced in volume form. Volume Five is the latest of the series and contains articles numbers XXV to XXXIII inclusive.

These articles were written as individual affairs; each author, or group of authors, studied such problems as interested him, within the limits of the information which could be extracted from the original survey questionnaires. These articles are not necessarily related to each other in the sense that the chapters of a book should be inter-related. Hence, it is impossible to review the volumes as books, except insofar as the reviewer wishes to comment on the basic methodology. By this time, however (1960), so many papers have been written on the methodology, that if compiled, they could easily form a Volume Six. Indeed, it would not be inappropriate to republish as full a discussion as possible of the methods and the lessons learned from them.

In this present review, then, I wish to confine myself largely to paper XXXIII, "Summary of the Chief Findings and Implications for Future Studies," by Clyde V. Kiser and P. K. Whelpton.

Twenty-three hypotheses had been built into the questionnaire originally. For summary purposes these were combined into five classes: I. Status and Security (including socio-economic status and feelings of economic insecurity and tension), II. Community and Family Background, III. Interest in Home and Children (liking for children, parental preference regarding sex of children, etc.), IV. Personality Characteristics (including feelings of personal inadequacy, fear of pregnancy, interest in religion, conformity to group patterns, etc.), V. Marital Adjustment and Husband-Wife Dominance. Each of these hypotheses had been so stated that a conclusion could be drawn as to whether or not it had been supported by the data. Although the analysis of each separate hypothesis makes fascinating reading, when viewed altogether, the results are largely inconclusive.

In addition to study of the individual hypotheses, a factor analysis was performed. This used thirteen scales (each one representing a group of questions without respect to any original hypothesis), seven socio-economic variables, a measure of family planning, and actual fertility. "The significant factors in this prediction were found to be the socio-economic or 'material style of life' factor and the extent to which fertility was planned (a factor generalized as the 'successful-modern-rational family' factor) which together accounted for 59 per cent of the total fertility variance that was controlled. The remaining factors added only 2 per cent to this prediction" (p. 1358).

In summary, then, it would appear that we still have very much to learn about the social and psychological factors affecting family planning and the level of the birth rate. At least two other studies are now underway in an effort to fill in these hiatuses, Growth of American Families, and Social and Psychological Factors Affecting the Future Fertility of Two-Child Families.

If this reviewer may be permitted to hazard a guess regarding studies of this

nature, it is to the effect that no study dealing only (or almost exclusively) with the individual and his immediate family will be very productive of findings. People live in a culture which operates upon them and leads them to act in certain ways. Thus we observe, for example, that the Asians differ from Europeans in many respects because of their different cultural backgrounds, and Germans differ from Frenchmen; even within the United States we think of New Englanders as being different from Texans, for example. And these cultural differences (and sub-cultural differences) are real and somehow must be taken into account in trying to explain family building patterns.

Furthermore, and what is most important, is that the individual himself often is unaware of these forces operating upon him and cannot even begin to attempt to explain his actions. He acts in a certain manner, or has certain feelings or attitudes because they were instilled into him by the larger culture. Thus, for example, in cultures having high fertility it is very easy for the family to have another child simply because that is the customary way to act. This, it seems to me, is brought out neatly in P. S. Mennon's unpublished M. A. dissertion (Columbia University, Sociology Dept., Feb. 1960), "Attitudes Toward Family Size and Related Factors (Major Findings of the Fertility and Attitude Survey Carried Out in Mysore State, India, by the United Nations and the Government of India)." Apparently, the number of children which an Indian family had was determined in large measure by the community and the cultural forces operating upon the husband and wife; the purely individual psychological traits seemed to be much less important.

In addition to this cultural background, there may be temporary fads and fancies operating. In the United States, for example, during part of the 1930s, it was not the fad to have children (this, in turn, was related to the stage of the business cycle as well as other cultural factors), whereas following World War II it became the fad to have children. Everybody was having them, so why not you, and you?

The social and psychological factors affecting the individual and his immediate family are, then, superimposed upon the cultural background (which, it should be noted, need not be a constant over long periods of time), and the more temporary fads and fancies. Hence, the individual's social and psychological factors, at best, can account for only a small part of the observed variance in human behavior.

It would seem, then, that perhaps much of the success obtained in using socio-economic position and educational level in accounting for social phenomena —particularly the level of the birth rate —stems directly from the fact that these variables reflect certain aspects of the larger cultural (or sub-cultural) background; only secondarily may they reflect any social and psychological characteristics of the person.

If there is any validity to these opinions, then future studies of family building patterns in the United States must somehow take into account the larger cultural background and the prevailing (at the time of the survey) fads and fancies, before the proper relevancy of the individual's social and psychological factors can be ascertained. Only by so doing may we be able to explain why the

U. S. birth rate is now (1960) higher than that in Scandinavia or the United Kingdom or even in France and Italy, which are predominantly Catholic.

Similar comments can be made about the peoples of underdeveloped areas. One school of modern type "missionary" has taken it upon itself to convert the "heathen" to family limitation patterns. For this purpose they may try to use the scientific findings of the anthropologists, which are largely analyses of the cultural factors leading to high fertility. When this is done the factors conducive to high birth rates are much better understood, but understanding does not automatically produce a practical mechanism for lowering the birth rate. At this point the "missionaries" then employ marketing research and advertising methods in an effort to convince the individual person or family to lower its birth rate. And it is precisely at this point that it would appear that these marketing methods are of little use, for they do not and cannot take into adequate consideration the background culture. In summary, study of the social and psychological factors from the viewpoint of the individual or his family, whether in the United States or in a foreign country, and when abstracted from the basic culture, will prove to be largely fruitless.

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The Population Explosion and Christian Responsibility: Richard M. Fagley. Oxford University Press, New York, 1960, 260 pp., $4.25.

The Rev. Thomas R. Malthus has a worthy successor in the Rev. Richard M. Fagley as an interpreter of the dangers of reckless procreation. He views it as "the chief enemy of free society in the world today."

Unlike many advocates of "planned parenthood," Dr. Fagley is not imbued with the conservative or reactionary ideals which so often have made neo-Malthusianism anathema to the socially and economically progressive forces in the world. He writes of the "revolutionary ferments" which are animating the poorer countries of the world and examines various aspects of a total program for raising levels of living, one of which is responsible parenthood.

Fear of Roman Catholic reactions to governmental and inter-governmental action toward meeting requests for information and technical assistance in the application of intelligence to the spacing of births is widespread, and justified, as the U. S. Occupation in Japan, among others, can testify. Dr. Fagley does not spare his Protestant co-religionists, however. He points out that "most of our Victorian churches took an attitude that differed little from that of the Roman Church."

He then enters a field in which many modern writers, schooled in scientific procedures, and guided by rationalistic thinking, are likely to be impatient. Why not consign Augustine, Ambrose, Jerome, Paul, Aquinas and their ilk to the scrap-heap of history and proceed to work out a modern approach to life and to marriage, with the needs of human beings as the basic consideration? Are their views as interpreters of the folk-lore of obsolete tribes, of any more value than those of the "advanced herbalist" recently quoted in a Chinese legislative debate on population, whose prescription for preventing conception was

twenty-four fresh tadpoles swallowed in two days in the spring?

Other writers would have played up the "fertility cult" aspects of Roman thinking. Dr. Fagley does write that "The aggressive if generally ill-informed 'fertility cult' has been the stronger faction to date." An illustration is found in a recent Catholic University Press book, highly praised in Church "family life" circles, which takes the attitude that "The family which courageously and even heroically rears a large number of children in an overpopulated area merits special praise for its virtue."

However, Dr. Fagley believes that Catholic theology is growing out of and beyond the emphasis on obsolete values and toward a more human and humane conception of marriage as "the blending of life as a whole and the mutual interchange and sharing thereof." (Pope Pius XI)

The author has avoided the polemical stance, which must have been a real temptation; has written an interesting review of the major facts and ideas in the fields of both demography and theological developments; has kept both his temper and his sense of humor and has still sounded a rousing call to Protestant thought and action to counter the influence of the "fertility cult" preachers and politicians.

CLARENCE SENIOR
Columbia University

NOTES ON RECENT PUBLICATIONS

BIRTH CONTROL AND PUBLIC POLICY—A Report to the Center for the Study of Democratic Institutions: Norman St. John-Stevas. 1960, 83 pp., free (paperback).

Americans are hopelessly divided on the question of birth control, but some working agreement about public policy can be reached with knowledge of the factual situation, declares the author of this scholarly survey, himself a Roman Catholic. These topics are covered: history of contraception in the United States and England, non-Catholic Christian opinion, contraception and the Roman Catholic Church, Catholics and the law.

The author concludes that the rhythm method could be employed more widely, being the only possible method of international family planning acceptable to all major religions, and that the United Nations policy of neutrality on contraception is unavoidable.

The Roman Catholic community in England and the United States would be wise not to urge a total legislative ban on contraceptives. A statute forbidding contraception such as that in Connecticut violates Catholic principles of jurisprudence, according to St. John-Stevas.

A very useful bibliography is appended.

OVERPOPULATION—A Catholic View: Very Reverend Monsignor George A. Kelley. Paulist Press, New York, 1960, 96 pp., 75¢ (paperback).

Our inability to see far into the future should make us wary of short-term solutions, warns the author of this discussion of population problems within both a sociological and religious framework. The revolution in the expectations of the world's people may well be the principal impact of science on man, according to Monsignor Kelly. He considers such subjects as increasing resources, creative productivity, education, migration, discouraging teen-age marriages, and limitation of births. If resources are insufficient, then legitimate population control might be employed, but continence is the only legitimate means. The ultimate solution lies within the Providence of Almighty God.

AND THE POOR GET CHILDREN—Sex, Contraception, and Family Planning in the Working Class: Lee Rainwater. Quadrangle Books, Chicago, 1960, 202 pp. (paperback, not for public sale).

A study conducted for the Planned Parenthood Federation of America, Inc. by Social Research, Inc. of the background of social and psychological factors influencing working-class people in family planning and contraception. Includes interviews with 96 working-class men and women.

The lack of effective contraception common in the group studied was found not to be due simply to ignorance or misunderstanding; it stemmed also from personalities, world views, consistent ways of life, all of which do not readily admit planning and contraception. The study concludes, however, that there is a solid motivational base to encourage many working-class husbands and wives to have fewer children. Possible educational efforts here are outlined.

THE MEANING OF WILDERNESS TO SCIENCE—Proceedings of Sixth Biennial Wilderness Conference. Sierra Club, San Francisco, 1960, 129 pp., $5.75.

We cannot save our wilderness unless we stem the multiplication of our population in the very near future, state the proceedings of this conference on wilderness and science held by the Sierra Club. In the chapter on Population Pressure and Natural Resources, Raymond B. Cowles declares that we are already ecologically out of balance with our world and are outgrowing our resources in terms of our population size. Protecting wilderness is only one facet of a much larger problem of protecting the ecological security of the human race.

Cowles suggests that bonuses might be given to couples for *not* having children in order to check too rapid population growth, such bonuses producing eugenic results also because they would be most effective among the poorest and least educated.

The Conference adopted a resolution that research on human population problems be greatly increased and that social, governmental, and other agencies give urgent attention to developing desirable population controls.

ANNUAL REPORT OF THE POPULATION COUNCIL: 1959. Reports of the Executive Officers, 230 Park Avenue, New York, 44 pp., free.

This report summarizes the work of the Population Council during 1959 in carrying out its stated aim: to develop scientific and technical information to assist the world's people in coping with their own population problems. The Council itself does not advocate specific policies for our own government or for any other.

The President of the Council, Frank Notestein, notes advances in the medical and social fields, including training of technical personnel, research and experiment and international consultation. More trained workers are also available in the field of physiology of reproduction, and many more research projects are in existence than a few years ago.

Twenty-one full fellowships in demography were awarded by the Council in 1959 in thirteen countries, a number of these for support of population studies in Asia. Seven additional supplementary grants were made. In medical research twenty-four grants were made, eleven outside the United States. The largest grant was given for studies on cervical secretions, emphasizing the immunochemical and enzymatic mechanisms related to reproduction. During 1960 there will be considerable increase in attention by the Council to studies of immunologic mechanisms.

The real problems are not those of minimum subsistence in a distant future, concludes Notestein, but the attainment of health, education, and relief from gross poverty for all the world in the next few decades.

AN OUTLINE OF CHEMICAL GENETICS: Bernard S. Strauss. Sanders, Philadelphia, 1960, 188 pp.

Relates recent developments in the study of nucleic acids to genetic theory for readers with some knowledge of chemistry but little genetics. Based on lectures given to graduate students in the Faculty of Medicine at Osaka University, Japan. Topics covered include genetic control of protein synthesis, chemical nature of the hereditary material, molecular meaning of genetic recombination, mutation as a chemical process, nucleocytoplasmic relationships and protein synthesis, biochemical genetics of man.

The principles of chemical genetics discovered with microorganisms are valid for man and vice versa, the author states. He believes that it is possible to outline a program for studies in medical genetics and hopes that such departments may become the rule rather than the exception in medical schools. Genetics departments must indicate both to physicians and the public the role of genetic factors in disease and the methods by which man may make the best of his genetic inheritance in his changing environment, the volume concludes.

SELECTED BIBLIOGRAPHY OF CONTRACEPTION—1940 to 1960: Christopher Tietze, M.D. (Editor). Publication No. 6, National Committee on Maternal Health, New York, 1960, 76 pp., $1.00.

Covers the medical and sociological literature on contraception which has been published in the languages of Western Europe from 1940 to the early part of 1960. Lists primarily those studies which are directly relevant to clinical application. Better coverage has been achieved for the more recent years than for the earlier part of the period, according to the editor. Supplementary lists will be published from time to time.

HELEN HAMMONS
American Eugenics Society

Periodical Reviews

GENETICS

Malformation syndrome in man associated with triploidy (69 chromosomes). J. A. Böök and B. Santesson. *Lancet*, 7129(1960), pp. 423-425.

The phenomenon of triploidy has been known in certain invertebrates and plants for many years. For example, in *Drosophila melanogaster*, normal diploid females with 8 chromosome, through the failure of the meiotic process, produce eggs with 8 chromosomes spontaneously at a very low frequency. The fertilization of these exceptional eggs by normal sperm results in triploid flies with twelve chromosomes.

The investigators have now reported on the remarkable occurrence of a human triploid. An infant boy was brought to a pediatric clinic because of recurrent attacks of fever combined with disturbances of consciousness. An examination showed retarded development, localized lymphomatosis, cutaneous and bony syndactyly of his hands and feet, and porencephaly.

Skin biopsy specimens were taken and chromosome studies initiated. The evidence was conclusive that 69 chromosomes were present. Each autosome was present three times, and the sex chromosome complement consisted of two X chromosomes and one Y chromosome. It appears, then, that the mother produced a 2N exceptional egg which was fertilized by a normal Y-bearing sperm.

Galactosemia. H. N. Kirkman, *Metabolism*, 9(1960), 316-325.

Previous to 1950, less than 20 cases of galactosemia had been described accurately in the literature. However, with increased awareness of the symptoms by physicians, many cases have been described in recent years and it is now apparent that the disease is not as rare as previously considered.

The symptoms are often recognizable soon after birth with the appearance of jaundice, hepatomegaly, cirrhosis, cataracts, galactosuria, aminoaciduria, and failure to grow. Death may occur during infancy and surviving cases often show mental deficiency with IQ's in the range of 50 to 75. Mild cases may not be detected until childhood.

Genetic studies indicate that the condition is due to an autosomal recessive gene. Individuals with the genotype are unable to carry out one step in the conversion of galactose to glucose. Galactose is a normal component of mammalian milk. Galactose 1-phosphate accumulates because of the absence or inactivity of the enzyme phosphogalactose uridyl transferase. The accumulation of this substance is responsible for the disorder.

It is now apparent that if individuals with the responsible genotype are detected soon after birth, and galactose kept out of their diet, development will be normal. This demonstrates dramatically how the symptoms of a particular genetic disease can be prevented through controlled diet. By measuring enzyme activity, carriers of the recessive gene, i.e., heterozygotes, can be discerned. They show significantly less enzyme activity than normal non-carrier individuals.

A mongol girl with 46 chromosomes. P. E. Polani, J. H. Briggs, C. E. Ford, C. M. Clarke, J. M. Berg. *Lancet*, 7127(1960), pp. 721-724.

One of the major contributions of the field of human cytogenetics to date is the demonstration that mongolian idiocy is associated with the trisomic condition of a small autosome. The chromosome in question has a satellite and is now known to be the next to the smallest autosome.

Since it has been demonstrated that the incidence of mongol births increases with the age of the mother, it seems apparent that non-disjunction for at least this chromosome shows a positive correlation with increasing age in females. This suggests that if some cases of mongolism have an etiology other than non-disjunction and trisomy, the probability of discovering these types would be increased by studying mongols born to young mothers. With this is mind, the investigators studied three of these types of mongol children by the bone marrow technique. One cell culture failed; one showed cells with the typical 47 chromosome number; and one showed cells with a chromosome number of 46.

A detailed examination of the chromosomes in the exceptional mongol with 46 chromosomes revealed the presence of a possible translocation. The authors propose that most of the small autosome that is found in the trisomic condition in most mongols, through a reciprocal translocation in a previous generation, became attached to one of the medium-sized autosomes. Therefore, even though the exceptional mongol has a normal number of chromosomes, enough of the genetic material of the small autosome is threefold that characteristics typical of mongolism are present.

Information obtained from plant and animal cytogenetics would predict that such a mechanism for producing mongols could exist in man. It also demonstrates further that two normal parents could produce multiple mongol offspring through chromosome segregation if one parent is a translocation heterozygote.

Genetic factors in thyroid disease. F. D. Kitchin and W. Howel Evans, *Brit. Med. Bull.*, 16 (1960), pp. 148-151.

This article appears in a journal that is devoted entirely to the thyroid gland. Although the contents of this article deals exclusively with genetic factors in thyroid disease, the same subject appears in other papers by other authors in the same journal. These papers taken collectively give an excellent survey of the subject and are recommended highly for workers interested in this field.

The authors point out that the familial incidence of certain thyroid diseases has been known for many years. Definite genetic factors have been incriminated for toxic diffuse goitre, goitrous cretinison, congenital deafness with goitre, plus other rare conditions. Genetic factors have not been involved for carcinoma of the thyroid and thyroiditis. A big problem is to elucidate the roles environmental and genetic factors play for simple goitre.

Of interest is the relationship that certain thyroid conditions have with the ability to taste phenylthiocarbamide. In Caucasian populations, approximately 30 per cent of all individuals are unable to taste this compound. The authors quote the results of a study carried out on 265 normal individuals, 246 individuals with adenomatous goitre (toxic and non-toxic), and 133 individuals with

toxic diffuse goitre. The frequency of non-taster individuals among each type was 29.4 per cent, 39.4 per cent, and 16.5 per cent, respectively. They conclude that the taster and non-taster genotypes are important in determining what type of goitre disease may develop, i.e., the genes determining the taste response to phenylthiocarbamide interact in some way with the genes or gene for thyroid disease.

Inheritance of cancer of the stomach and large intestine in man. M. T. Macklin. *J. Nat. Cancer Inst.*, 24 (1960), pp. 551-571.

Within recent years several studies have been carried out for the purpose of investigating the etiological importance of heredity for common types of neoplasia. The author has been a pioneer in this field and is one of the most exact workers.

In this study the author investigated the families of 167 patients with stomach cancer and 145 patients with cancer of the large intestine. The proportionate death rates due to cancer in these relatives were then compared with values obtained for the general population controlled for age and sex. The author concludes that gastric and intestinal cancer show familial aggregations compatible with a genetic hypothesis. Furthermore, it is evident that the genetic mechanism predisposing to gastric cancer is not the same as the one predisposing to cancer of the large intestine. In each case the mechanism is probably polygenic.

Of importance is the observation that spouses of gastric cancer patients do not show an increased risk for this type of cancer. This suggests that environmental factors present in the home environment during adult life are not of etiological importance, and enhances further the plausibility of the genetic hypothesis.

Studies of alcaptonuria: inheritance of 47 cases in eight highly inter-related Dominican kindreds. R. A. Milch, *Am. J. Human Genet.*, 12 (1960), pp. 76-85.

Alcaptonuria is noteworthy from a historical point of view since it is the first described "inborn error of metabolism" and one of the first traits in man to be shown to be inherited in a simple recessive Mendelian manner. The defect arises because of the absence or inactivity of the enzyme homogentisic acid oxidase. As a result, homogentisic acid accumulates and appears in the urine. The urine becomes darkened when it is exposed to air.

Although alcaptonuria is considered to be a typical recessive trait, reports of families from the Dominican Republic have occurred in the literature, suggesting dominant inheritance. These reports stimulated this investigation by the author, who theorized that the families may be so inter-related and inbred that dominant inheritance was only simulated.

An extensive search was made for the family members. The results showed eight highly inter-related kindreds with 47 identified patients covering eight generations. Even though the trait has appeared in successive generations, due to the mating system that has occurred, the distribution of cases is still compatible with the hypothesis of inheritance due to a rare, autosomal, recessive gene.

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POPULATION

Demographic Dimensions of World Politics. Philip M. Hauser. *Science* **131,** 3414 (3 June 1960), pp. 1641-1647.

Knowledge, Action, People. Frank W. Notestein. *University* **2** (Fall 1959), pp. 21-23.

These papers have much in common. Each is the work of a demographer of high distinction. Each was originally prepared as an address for a demographically "lay" audience—Hauser's article as his vice-presidential address for Section K of the American Association for the Advancement of Science, Notestein's for a convocation at Haverford College. Both writers offer a broad view of the significance of population for human welfare, and each tackles the problems of policy which currently face us. And each paper distills ideas which the author has been developing in more technical writings over a considerable period.

Much of the Hauser piece is devoted to illustrating the dimensions of the world population problem in terms of statistics. "Projection of the post-World War II rates of increase gives a population of one person per square foot of the land surface of the earth in less than 800 years. It gives a population of 50 billions (the highest estimate of the carrying capacity of the earth ever calculated by a responsible scholar) in less than 200 years." Taking the United Nations "medium" estimate of a 6.3 billion world population by the year 2000, Asia would have to increase her aggregate income 62-fold to reach the 1950 North American standard, or 21-fold to reach the 1950 European level. "The control of rates of growth would unquestionably decrease the magnitude of the task of achieving higher levels of living in the underdeveloped areas, especially those with populations which are large relative to resources." In the absence of such control, Hauser believes that existing differences will grow rather than diminish.

Hauser sees the "race" for economic development between India and China as an especially crucial test of democratic versus Communist methods. At the same time, he sees no reason for optimism about the future of any of the underdeveloped areas. He believes that frustrated development will increase the blandishments of Communism, and that "success or failure in this crucial contest may well hinge on the ability of the nations involved to decrease their rates of population growth."

The alternative methods of decreasing growth are (1) increasing the death rate, (2) decreasing the birth rate, or (3) some combination of the two. Since diminishing efforts to increase longevity is "unthinkable," only the second alternative is considered. "If longevity gains are to be retained . . . the only way to reduce population growth is to decrease the birth rate." The author believes that man "is probably ingenious enough to devise methods by which the population explosion can be controlled within the framework of man's diverse value systems."

Notestein's paper begins about where Hauser's leaves off. What are the prospects for reducing fertiliity within the framework of existing value systems?, he asks. Mortality will on the whole fall responsively when information about control becomes available. Fertility is more complicated, being supported by a whole complex of ideals and values. "Life would be quite impossible if mo-

tives, beliefs, and loyalties could be manipulated as easily as information." Therefore the spread of fertility control lags behind the dissemination of death control. "The essential task . . . is to weaken large family loyalties and build new loyalties centering around the small family and the improvement of living conditions for parents and children; to enhance the importance and dignity of the individual life as opposed to that of the extended family group." The ideal of many children needs to be transformed into an ideal of fewer, but healthier, children. But "because the matter is so clearly tied to moral and religious values, there is little the Westerner can do *directly* . . ." Under the circumstances, "one of the most effective contributions the West can make is to train scholars from underdeveloped areas to study their own population problems by modern methods. These technicians are in a strategic position to call the attention of their own people to the consequences of alternative courses."

Although the point is nowhere made fully explicit, Notestein seems to rely on information to modify values. Such information is said to be more acceptable if proffered by scholars who are citizens of the countries in question. The emphasis is on the incompatibility of continued high fertility with health and longevity. One gathers that if knowledge is to cope with population, the growth of knowledge will also have to be "explosive."

The Gains to India from Population Control: Some Money Measures and Incentive Schemes. Stephen Enke. *Review of Economics and Statistics* 42, 2 (May 1960), pp. 175-181.

Can the costs of fertility be quantified? Such a question can probably be answered only in terms of utilitarian values. Even in these terms, economic gains and losses are much more readily measurable than social and psychological ones. Enke attempts to estimate the economic burden resulting from high fertility in India, where the marginal productivity of additional population is generally agreed to be less than its drain on resources. One need not endorse all of the author's contentions to find his conclusions interesting.

Enke presents three sets of estimates: (1) the economic value of preventing one birth, (2) the costs and savings associated with a scheme for government-supported vasectomies for men, and (3) the costs and savings associated with a scheme for government-supported nonpregnancy payments for women. Applying a fairly heavy discount rate (10 per cent per year, compounded annually) to consumption gains extending into the future, the author estimates the present value of a permanently prevented birth to be over two and a half times the annual per capita consumption. Most alternative methods of calculation produce even higher estimates of the saving. "A rock-bottom estimate . . . would seem to be Rs 500-600 [approximately $100-$120] . . . This estimate is 'conservative' and . . . independent both of assumptions regarding the capital-output ratio and the marginal productivity of population. This means that, as aggregate output and price levels rise, the value of a prevented birth will remain at least twice the per capita consumption." The impressive magnitude of potential aggregate savings from a reduction in fertility leads the author to a consideration of possible incentive schemes for reducing the birth rate:

Vasectomies. The author suggests that a large-scale Indian government program of vasectomies could be developed, employing bonuses which could readily be paid for out of the savings resulting from reduced fertility. "Three [Indian] states and one large private company already offer free vasectomies, sometimes with a bonus, to certain of their employees." It is suggested that the "overhead" costs of such a program would be extremely low, since vasectomy is not an operation requiring great medical skill, "is practically irreversible and can be performed within half an hour with a local anesthetic." The potential gains are so great that "quite high bonuses may be appropriate at the outset," gradually being reduced as the program gains public acceptance.

Non-pregnancy payments. A moderately elaborate scheme of payments to married women who successfully avoid pregnancy for various periods of time is outlined. Initial bonuses would be paid into a blocked account, with unblocked bonuses and interest on the blocked balance beginning after three years of non-pregnancy. From that time forward the payments would be "more than sufficient to support one of the family's children. The blocked account is released to the woman at age 45, or to her family should she die previously, unless cancelled."

Estimates of the resource and money costs of these programs in relation to potential savings lead Enke to conclude that "bonuses are an attractive alternative to traditional investments if the object is to increase per capita consumption over 10 years." It is hardly necessary to add that at least one of the programs proposed by the author raises extremely controversial moral issues, issues perhaps more controversial in Western countries than in the areas most directly concerned. To this reviewer the most significant aspect of the paper is its attempt to calculate the economic costs of excess fertility.

Why Catholics Reject "Artificial Birth Control." Interview with Father William J. Gibbons. *U. S. News & World Report,* December 21, 1959, pp. 58-61.

An interesting contrast and complement to Enke's analysis for India above is provided by this interview with the well-known Jesuit demographer, the Rev. William J. Gibbons. Father Gibbons, whose views are presented in question-and-answer form, believes that "it is desirable that something reasonable and morally acceptable is done to slow down rates of growth [in some areas]. This is in addition to—by no means a substitute for—intensive economic development." He believes that both the Catholic and the non-Catholic demographer "would be very loath to see extension of such practices as abortion or complete sterilization—particularly if there were any element of compulsion about it—around the world in underdeveloped areas." The measures for achieving "responsible parenthood" which the author suggests that his church finds morally acceptable are (1) "delayed marriage, especially beyond the very productive years—in the late teens and early twenties," (2) "continence within marriage for a protracted period," and (3) "periodic continence or the use of the sterile period during the woman's monthly cycle." Mechanical, chemical or physical means of preventing conception are found to be morally unacceptable, but this does not imply that birth control "in the sense of responsible parenthood and the spacing of children" is inadmissible if "legitimate reasons" are present.

Father Gibbons emphasizes the importance of finding "simple tests for the fertile period which can be identified even by illiterate people." He acknowledges that "the successful practice of periodic continence requires considerable self-restraint and the exercise of the virtue of chastity. Therefore it can be recognized that many people will not be very successful in this particular method unless they are motivated by the principles . . . outlined," namely, principles similar to the Roman Catholic view of sex and reproduction. "If people have adequate motivation, if they have adequate instruction and if they have the sufficiently developed virtue of conjugal chastity, they could resolve the problem of excess fertility by this means."

Toward the end of the discussion, Father Gibbons remarks that "it's up to the people themselves to work out programs in line with their own interests and their own conscientious convictions, and that is the first principle we should bear in mind." In addition to this emphasis, the interview is marked by forthrightness in recognizing the challenge of human fertility in a world of improved mortality, and by careful specification of the limits within which "morally acceptable" methods may be expected to effectively reduce fertility. The concept of "responsible parenthood" provides a potential basis of agreement among adherents of several diverse value positions, and few will wish to take exception to Father Gibbons' plea for more research on the "rhythm" method of reducing fertility.

The Demographic Transition in the Netherlands. William Petersen. *American Sociological Review* **25**, 3 June, 1960), pp. 334-347.

Prevailing ideas about demographic history are based on a surprisingly small number of detailed historical studies mostly concerned with the British Isles and Scandinavia. Petersen's article provides an important addition, for it is really a survey of the fairly extensive literature on Dutch historical demography hitherto inaccessible to those of us who are unable to read Dutch in the original. The paper is a model of fruitful interplay of historical material and sociological analysis, using the Dutch data to reexamine what Petersen calls "that roughest and most simplistic of models, the theory of the demographic transition." His main points are as follows:

(1) "It is reasonable to assume" zero net migration during the course of the transition in the Netherlands (p. 335).

(2) It is probable that "the population increase characteristic of modern times began in the seventeenth century or earlier" (p. 338), although there was a plateau during the second half of the eighteenth century when the population remained "nearly static" (p. 337).

(2) "If there was any decline in general mortality . . . [before the middle of the nineteenth century], it was probably quite small" (p. 341). Thereafter, "the application of the most efficient means of death control effected not a transition from a static to a growing population, but the quickening of the rate of growth from 0.75 to 1.25 per cent per year . . ." (p. 339).

(4) There is reason to believe that Dutch fertility rose during the early transitional period. The typical Dutch rural joint household is examined by the author, and found to provide powerful checks on fertility through postponed marriage and through a high incidence of spinsterhood and bachelorhood. However, when conditions permit, there is a

rush into marriage which results in an "explosive" rise in fertility. There are several examples of this in recent Dutch history. Any breakdown in traditional farmily norms tends to produce a rise in fertility, and this phenomenon may be assumed to account for the fact that "urban fertility in the Netherlands was higher than that of the countryside until about 75 years ago" (p. 343). (The possibility that rural-urban migration may have produced an age-distribution favorable to fertility is not discussed by the author.)

(5) The following hypothesis is proposed to replace the conventional view of fertility changes during the transition:

> "In the *traditional family* typical of the pre-industrial period, the postponement of marriage, plus the nonmarriage of a portion of the population, constituted an onerous but efficient means of holding fertility in check. In the *proletarian family*, typical of the mass of either rural or urban workers released from the prior institutional and normative restrictions, there was no effective bar either to early marriage or to procreation. Indeed, social control was often barely strong enough to compel marriage once a child had been conceived. In the *rational family* type, which arose first among the middle classes during the 19th century and then gradually spread to the rest of society, a sense of parental responsibility reappeared, and with it a limitation of family size. The average age at marriage rose again, and later the same end was achieved with less privation by the use of contraceptives" (p. 346).

This reviewer would suggest that Petersen's conclusions are congruent with those of a number of scholars working on other areas, including Habbakuk and Krause on England and Wales, Ryder on Sweden, and Connell on Ireland. Moreover, although not suggested by the author, there is a striking parallel between Petersen's rural Dutch family and the French Canadian family as described by Miner and others (with the priesthood and religious orders providing additional outlets for bachelors and spinsters in the French Canadian case). Very possibly this pattern was transplanted to North America from rural France.

On the other hand, as Petersen himself indicates, the lack of quantitative data inevitably makes arguments about the early transitional period somewhat tenuous. As is well known, the initial impact of a decline in mortality soon produces an age-distribution favorable to higher fertility. Even in the absence of reliable data, it is possible to estimate the effects of alternative assumptions from hypothetical models. It may be suggested that failure to deal with the implications of changing age-distributions is the major weakness of an otherwise excellent paper.

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POPULATION REVIEW

A JOURNAL OF ASIAN DEMOGRAPHY

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GENUS

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